THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXX. No. 1783.] LONDON, JULY 13, 1897. [49TH YEAR. PRICE 6d.

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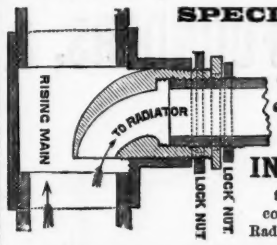

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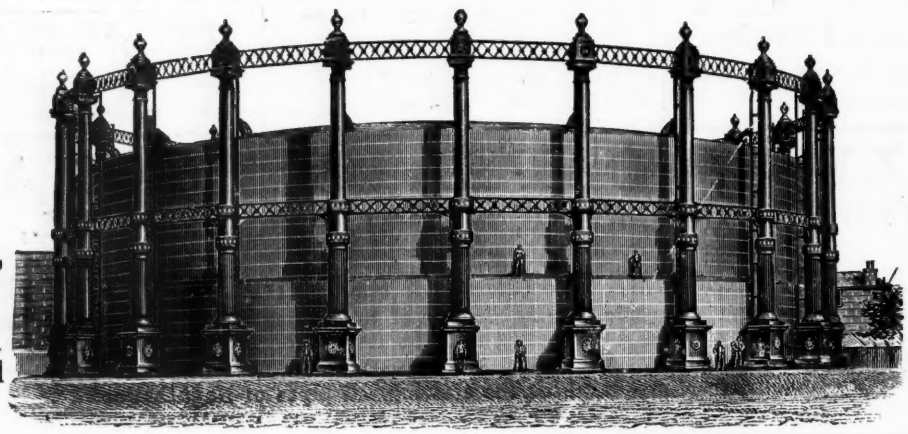

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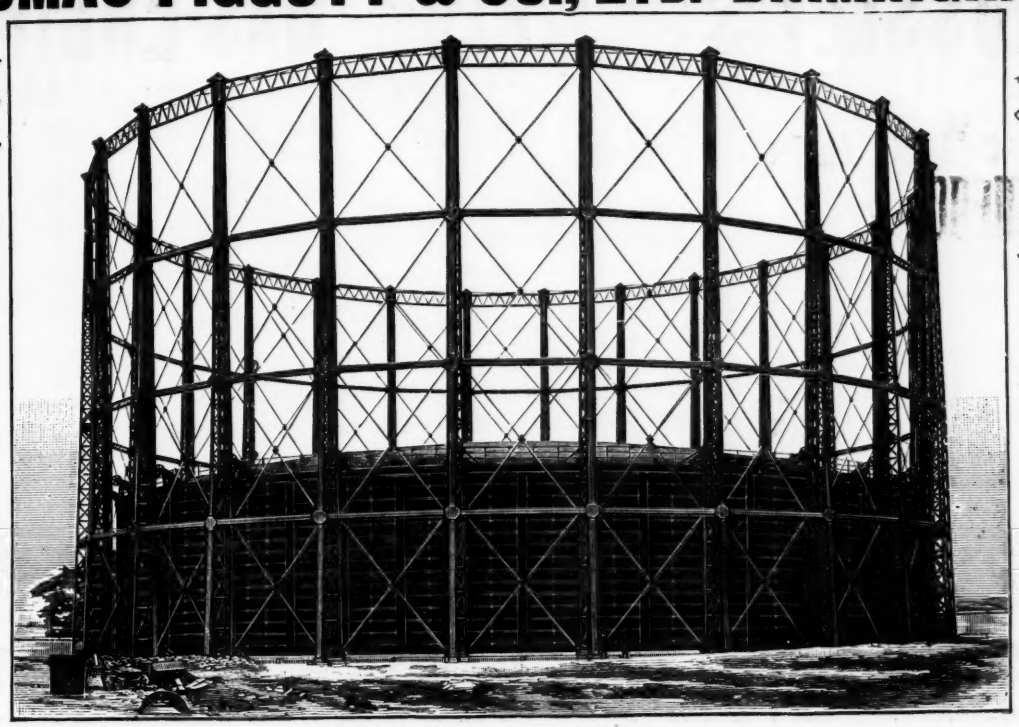

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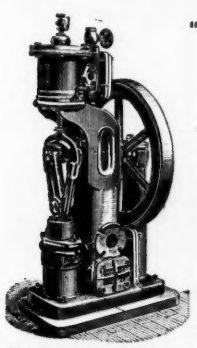

Fig. 705. "SINGLE RAM" STEAM-PUMP.

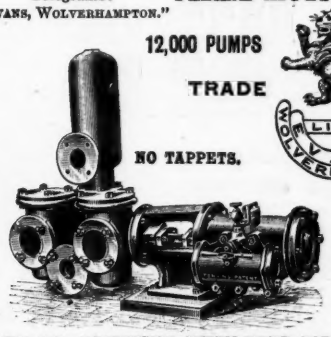

Fig. 808. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

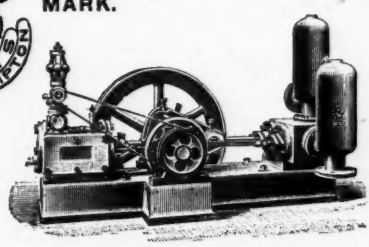

Fig. 685. "RELIABLE" STEAM-PUMP FOR TAR AND THICK FLUIDS.

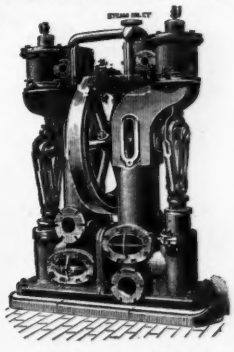

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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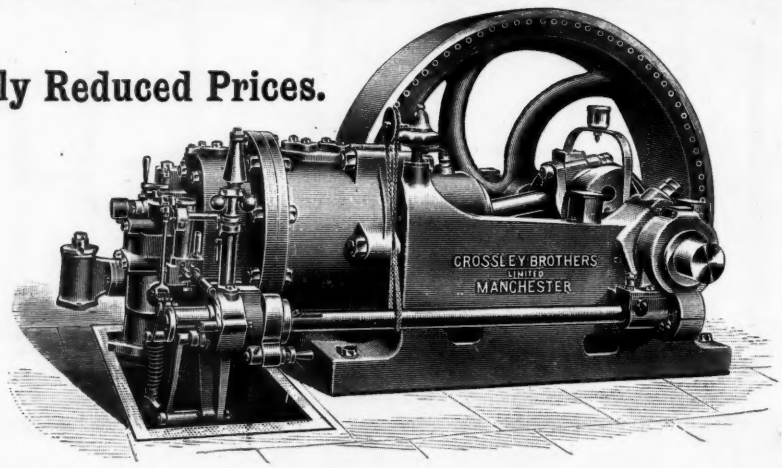

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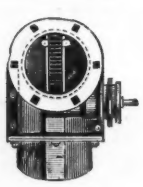

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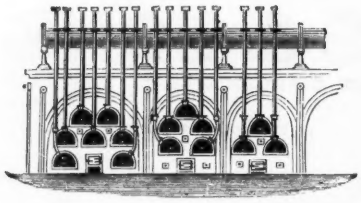

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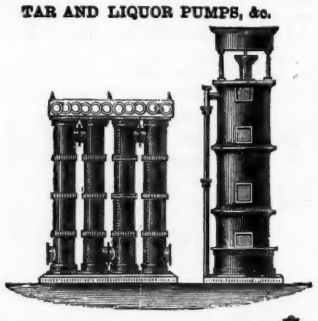

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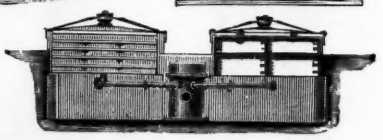

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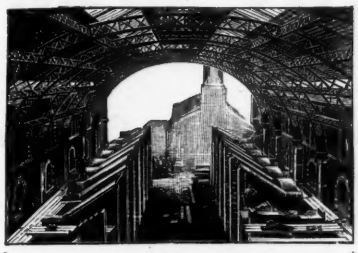

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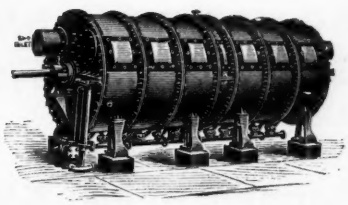

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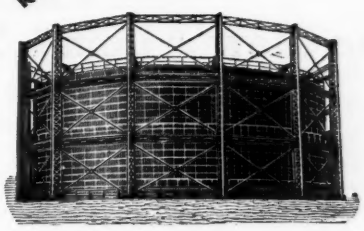

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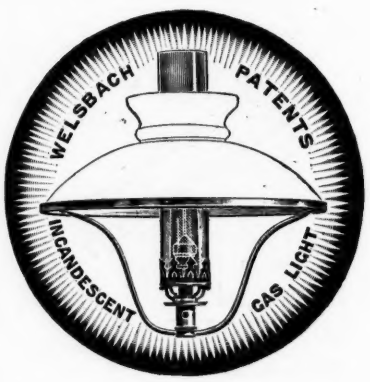

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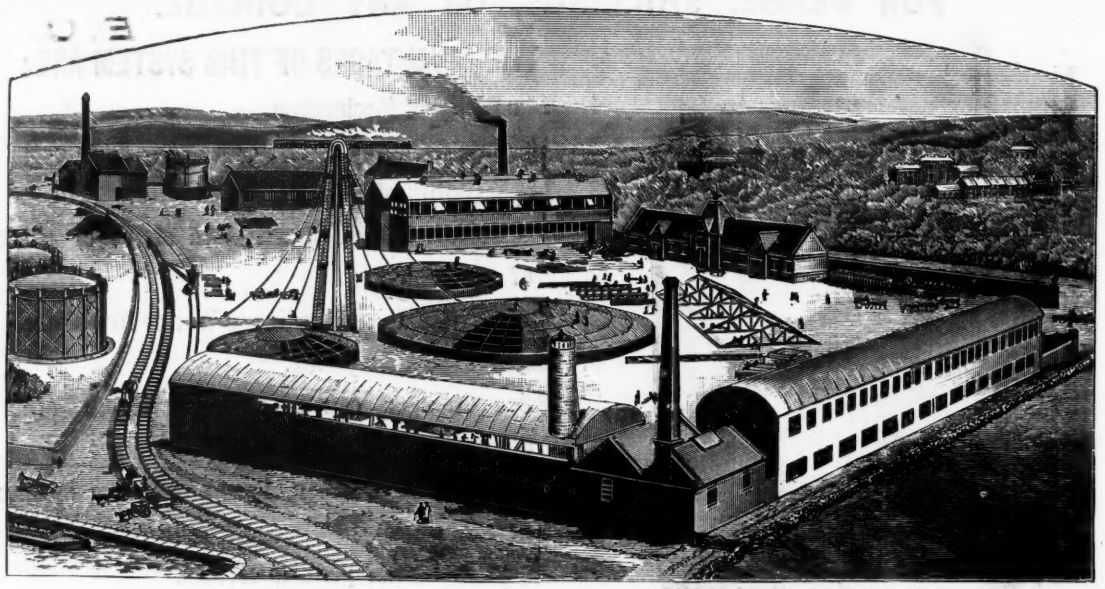

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AND WE FURTHER CALL ATTENTION TO THE EXTRACTS FROM THE JUDGMENT GIVEN BY THE HON. MR. JUSTICE WILLS, WHEN HE DISMISSED THE WELSBACH COMPANY'S APPLICATION FOR INJUNCTION:—

"No use is made by the Sunlight Company of any of the rare earths; and their choice of substances, and their method of applying the illuminants, appear to me to be **as wide asunder as the Poles** from those contemplated by Welsbach."

"Welsbach Company's Counsel, both admit that they have no case unless the Welsbach skeleton, of whatever resistant earth oxides composed, is within the Welsbach Patent. It seems to me that **this is just what Welsbach did not claim.**"

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IT IS STRONG AND CHEAP AND REQUIRES NO PIERS FOR ITS SUPPORT.

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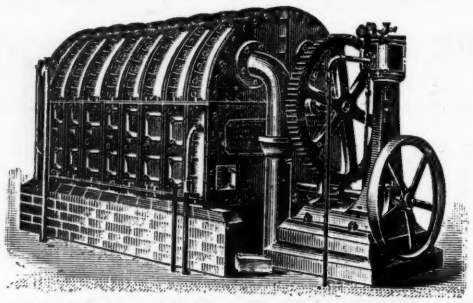

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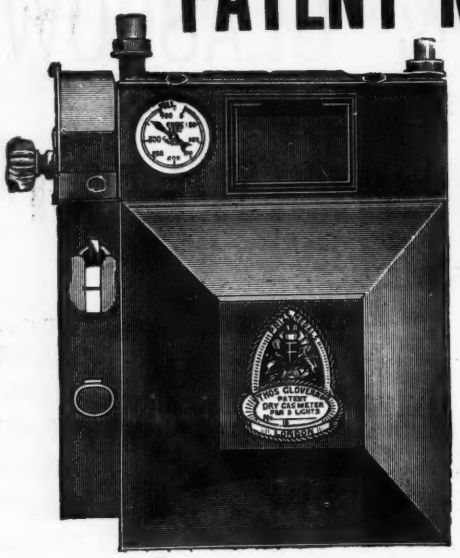

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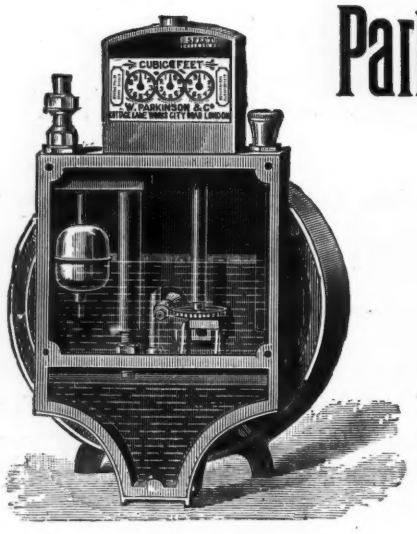

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[See also Advt. p. 144.

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EDITORIAL NOTES.

The Middlesbrough Gasholder "Accident."

AT last—the expression is not intended to convey a suggestion of undue delay—the technical world is in possession, by the means of Mr. Henry Woodall's report, which is published in another column, of all the facts of observation obtainable in regard to the failure of the Middlesbrough rope-guided holder. The incident is of sufficient importance, as forming part of the history of modern gas engineering construction, to be discussed in these columns; but it must be understood that, in whatever remarks we may have to make upon the matter now or at any future time, nothing is to be taken as a reflection upon the good faith of anybody concerned in the affair before or after the accident. The facts succinctly stated in Mr. Woodall's report are to be read in connection with the official statement that appeared in the "JOURNAL" for March 2 last. The holder is of three lifts, 30 feet deep, and is contained in a steel-plate tank 186 ft. 6 in. in diameter. On account of the bad character of the subsoil, the tank was built entirely out of the ground; resting upon a bed of concrete 3 feet thick, which was laid upon a natural bed of clay 5 feet thick. Below this was nothing but rotten, marshy ground. Mr. Woodall finds that the concrete foundation began to subside from the first; and it is still sinking. The subsidence is, however, not at all regular; the concrete having gone down from 9 inches on the eastern side to 17 inches on the western or lowest edge. The tank itself now shows about 6 inches out of level; while the bottom has become dished by another 12 inches in the middle. Consequent upon this movement of the bottom plates, the inlet and outlet pipes have been thrown 2 ft. 4 in. out of plumb in their length of 32 feet. It might be asked, first of all, whether a gasholder ought to have been placed in such a tank. Upon the evidence as it stands, most engineers would answer this question in the negative. At any rate, it is obvious that if the holder had been meant to work inside fixed guide-framing, it would never have been blown up until the latter was plumb, which condition would not have been realizable to this day.

However, the Middlesbrough Corporation wanted the holder; and as this was to be rope-guided throughout, the Contractors built it, and got the two inner lifts into what they considered to be safe working order. Here it becomes necessary to refer to a piece of evidence published by us on the date already given, and never disputed. The Contractors, finding that the tank guides were out of plumb, advised that the bottom lift should not be used so long as this condition existed. They were assured that this reasonable and necessary caution in the working of the holder would be exercised; yet, as a matter of fact, on Saturday, Feb. 20, the holder was filled with gas to the last two sheets of the outer lift. During the night, that happened which was inevitable in the circumstances. There was a high and squally wind, though not a strong gale, blowing from the south-west; and the holder, being deprived of the requisite support from its tank guides, had a twist from this direction. Then something gave way; one thing broke after another, and the holder canted over so as to spill the water out of the lutes, and allow the gas to escape. "Down she came!"—considering all things, in a wonderfully easy fashion.

We do not criticize Mr. Woodall's conclusions respecting the unsuitableness of the particular system of rope guiding applied to the outer lift, or the kind of guide-rail fixed in the tank. It is clear, however, that these are only secondary considerations. He asserts that the system of guiding was defective, and was "the cause of this unfor-"tunate accident." From this judgment we take leave to respectfully dissent; for the reason that, given the conditions that are known to have prevailed with regard to the tank and its guides, there is no possible kind or form of guiding that would have held the holder up. It is not a question of the character of the rope guiding, or the shape of the tank guides. The sole point is that these guides were not in the position they ought to have occupied with regard to the holder; and, this being the case, not ropes of steel, nor spiral guides, nor exterior fixed guide-framing would have availed to prevent the holder from meeting its fate. It was entirely due to the rope guiding that the result was no worse. Mr. Woodall applauds the system of guiding of the upper lifts. But it

must be remembered that the safety of these, independently of the outer lift, was never in question. Mr. Woodall's report makes the Contractors responsible for all damage traceable to the failure of the cables and their fittings. But to what was this failure due? Why arrest the tracing of responsibility at this point? Whatever the Contractors may elect to do in this regard, rather than allow any question to remain open in which the validity of their system of guiding may be involved, the only question for us and for the world of gas engineering generally is as to what was the cause of the mischief in the last resort. There is no stopping, in such an inquiry, short of the tank itself, and the improper filling of the holder. There was too much gas at the works on Saturday, Feb. 20. Rather than blow it off, somebody put it into the new holder, contrary to instructions. The holder was unfit to be filled, for reasons altogether outside its own construction; and everything that happened when this was done had been foreseen. This is the long and the short of it. The "accident" was one of those that need never have occurred, but will continue to occur to the end of time if men persist in outraging the conditions of prevention which are inherent in the nature of the things implicated.

The Manchester Gas Undertaking and the Price of Gas.

LAST week we published the principal figures relating to the working of the Manchester Corporation gas undertaking for the past municipal year. The increase in the consumption of gas in the district for the year was after the rate of 11·16 per cent., amounting in actual measure to upwards of 419¾ million cubic feet—the output of a very considerable gas-works. Moreover, the number of consumers of gas increased during the year by 13,405. This result was largely due to the extended use of prepayment meters, which are becoming very popular with the large operative population. The use of gas for purposes other than lighting is also increasing considerably. The financial result of all this enlargement of business was an increase of revenue of £42,116. The gross profit on the year's working amounted to £119,223, out of which £33,153 was paid for interest, and £17,745 towards the sinking fund. Of the remainder, the city fund was subsidized to the amount of £40,000; and the balance was transferred to a suspense account for wiping out the cost of the carburetted water-gas plant. This is a very typical illustration of the way in which the "ratepayers' responsibility" for a municipalized gas undertaking works out in practice. The annual report was considered at the City Council meeting on Wednesday, when a discussion arose as to the future application of the profits of the undertaking. The Gas Committee recommended that the price of gas in the out-townships should be reduced to 2s. 6d. per 1000 cubic feet, and meter-rents abolished, as from Michaelmas next. The same recommendation was offered twelve months ago, when it was rejected. Now it came on again, backed by a unanimous Committee. The proposal would still leave the out-townships with a surcharge of 3d. per 1000 cubic feet over the price paid by the citizens of Manchester. It meant a calculated loss of revenue of £10,250. Mr. Alderman King opposed the recommendation on financial grounds. The reduction might mean ¾d. in the pound on Manchester rates; and to talk of rates in the ears of a Manchester citizen at the present juncture is dangerous. This seaport town has a painful experience of the powers and requirements of rate collectors, and cannot afford to be generous to the gas consumers in the out-townships, to whom the Ship Canal is a mere engineering curiosity. Accordingly, after a brief discussion, it was decided that the price of gas must be maintained, at least for another month, when the question may be raised again. The prevalent impression appears to be that the reduction will be carried, especially in view of the fact that no such differential charge can be made by the Corporation for electricity in the same districts.

The Report Stage of the Workmen's Compensation Bill.

THE House of Commons was hammering away again last week at the *magnum opus* of the session—the Workmen's Compensation Bill. It is curious to see how, as time has passed, the chorus of approval with which this measure was greeted upon its introduction has been broken into by small, but poignant, notes of disapprobation from various quarters. The official Opposition has felt bound to profess, in and out of season, preference for the dead-and-gone Bill of Mr. Asquith, redolent as this was of the spirit of litigiousness. Then, again, the circumstance that Mr. Chamberlain has been largely responsible for the Government Bill is enough to damn the whole thing in the eyes of the noisy coterie of politicians who hate the very name of the Colonial Secretary. A small clique of would-be representatives of the interest of employers have mustered sufficient courage to divide against the Government upon certain points; and, naturally, the professional Labour members have dodged round the Bill in the endeavour to attach themselves to its most popular provisions. Notwithstanding all these disturbing influences—which do not amount to much, after all—the House of Commons has forged ahead with the Bill in that "unhasting, unresting" gait that the Mother of Parliaments yet knows how to take when there is real business to be done.

To descend to detail. On the order for the consideration of the Bill on Monday, the Home Secretary "opened the ball" with a new amendment, providing that wherever injury is caused by any other person than the employer, the workman may elect against whom to proceed. This proposal aroused unexpected hostility in the legal breast of Mr. Cripps, Q.C., who was "followed," as they say at the Bar, by Sir James Joicey and others of the employers' party who would be glad to see the Bill smothered by anybody else than themselves. Mr. Chamberlain, backed by the Attorney-General, stood firm; and eventually the amendment was carried by a vote of 351 to 43. A long wrangle over the application of contributory negligence by third parties followed; but it came to nothing. Next, Mr. Haldane moved a new clause, the object of which appeared to be to abolish in set terms the doctrine of "common employment." But inasmuch as this is done in every case of employment to which the Bill applies, greatly to the advantage of the workman, the proposal was unnecessary; and it was negatived. Mr. Cripps made another onslaught on the Bill, which was only repelled by a majority of 24; and then Mr. Asquith moved to omit the word "personal" from the proviso that where an injury was caused by the "personal negligence or wilful act of the employer," or of some person for whom he was responsible, his civil liability should remain unaffected by the Bill. This brought up Mr. Chamberlain, who argued that it was to the advantage of the community that proceedings for the recovery of compensation should, so far as possible, be taken under the Bill, and not by any alternative procedure. The dispute was not very material; and it was soon settled by a Government vote.

On the resumption of the debate on Thursday, the subject of discussion was a proposal by Mr. Wolff to omit the proviso in clause 1 that if the funds under any scheme between employer and workmen contracting out of the Act prove insufficient to defray the compensation, the employer shall be liable to make good the difference. Sir James Joicey supported the amendment, and once more several members tried to raise the whole question of the policy of the Bill and the acceptability or otherwise of "contracting out." The usual party wrangle followed upon the mention of these words; but eventually the amendment was defeated by a majority of 215. The position of the workman in the event of bankruptcy was the next difficulty. This question was discussed in the Committee stage, yet once more it was proposed to give priority to all compensation payable under the Act; and the proposal was defeated, on a division, by a majority of 78. A final attempt to extend the Bill to agricultural labourers was quelled. A long and acrimonious discussion arose on the limitation of the Bill to work on buildings exceeding 30 feet high. Mr. Souttar moved the omission of this limitation; and the Home Secretary had to make a fresh explanation of the reasons for its introduction, which, to say sooth, were not of the clearest or most convincing. With regard to the case of "house-breakers," again, the Attorney-General was fain to suggest that the question had better be raised "in another place." Shipbuilding yards gave a very considerable amount of trouble. At present, those yards in which mechanical power is not used are outside the scope of the Bill; and it was proposed to include them. Again the Government had to plead the difficulty of "drawing the line," if once the House forced them outside the limits of the Factory Acts. In regard to the shipbuilding yards,

however, the representatives of the industry themselves pressed the Government to yield the point; and this also is to be done by a clause to be moved when the Bill gets to the House of Lords.

The further consideration of the Bill was to be taken last night, when it was the intention of the Government to have the stage finished. On the whole, though a good deal of carping criticism has been vented with respect to the course taken by the Government and the House, the Bill was distinctly improved by last week's proceedings.

The Strike in the Engineering Trade.

THERE is not very much to be said at present about the strike of the Engineering Trades Unionists for the eight-hour day, which began in London last week, and threatens this week to become general. On Friday, Mr. Barnes, the Secretary of the Amalgamated Society of Engineeers, issued a statement to the members of the Society which fairly describes the situation from the Trade Union standpoint. He admits that a trial of strength between the associated Trade Unions and the Employers' Federation was inevitable; and he regards the present as a favourable time for bringing it off. "Trade is brisk, "the weather good, and the issue a popular one." This is, at any rate, a straightforward way of putting the case, and as such it will be more generally approved than the whining protestations with which the intending strikers started. We cannot work up any sentiment over either the men's or the masters' positions. The men think the time ripe for forcing upon the employers generally an amelioration of the working conditions of the trade which many of the leading firms, including the Government, have already conceded. The protesting firms say they cannot make the concession demanded by the men; and now everybody is waiting to see which side will win. Naturally, the newspapers have misunderstood the question, and are darkening counsel with their ill-informed comments and blundering advocacy of one side or the other. It is impossible to accept the plea, advanced by the Press advocates of the employers, that the engineering trade of the country would perish if the men's demand were granted. The fact of the thing having been done already in shops that are by no means behindhand in the commercial race, is proof enough that there is no impracticability in it. Nor do we believe, as some put it, that the men are going for the eight hours simply and solely with a view to the overtime aspect of the proposal.

Of course, there are mixed motives on both sides in this struggle; and it will probably not be far wrong to opine that the main object of the Employers' Federation in precipitating a national lock-out is that of reducing the power and pretensions of the A.S.E. Mr. Barnes evidently feels this; for in his manifesto to the members he complains that the masters, among other things, have "issued broadcast through the Press the most barbarous "and cold-blooded calculations" as to the resources of the Society. This is a childish wail; for what is there either "barbarous" or "cold-blooded" about the actuarial computations that have been made public for some time past respecting the financial condition of the A.S.E.? It is, indeed, suggested in more than one quarter that the A.S.E. executive would not be half sorry if the coming conflict were to be so sharp as to obliterate all questions save that of the life or death of Trade Unionism. Many a bankrupt community has sought in foreign wars relief from the necessity of dealing with home finances. If the A.S.E. wins now, it will be a famous victory; and if it loses, the defeat will be palliated by consideration of the noble cause to which the funds and the men were sacrificed. Defeat would be followed by financial reconstruction, in which all existing claims would be wiped off. From this point of view, therefore, the A.S.E. stands to gain as a Union, whatever may be the prospects of the individual members. Again, it is being hinted that many of the latter, not being annuitants of the Society, would not be inconsolable if the whole organization were smashed into fragments. It is rumoured that if the employers have cause to fight once for all for deliverance from the chains which the A.S.E. has forged for the engineering trade, the private members who happen to be good, steady workmen are almost as desirous of seeing the Society brought down to the position from which it started. If the multitudinous rules and regulations of the Society and the unwritten laws by which the District Committees act are a plague to shop management, the contributing members are just as grievously oppressed by them. At all events, the occasion appears to be set for bringing all these matters to an issue. Of course, the strikers profess that the "conflict could not have been honourably "avoided;" and they put upon the shoulders of the employers the blame for causing the trouble. Inasmuch, however, as Mr. Barnes elsewhere glories in the "favour-"able opportunity" that has been taken for raising the question of the eight-hour day, and that it is the men who are asking for something, this artless pretence will not deceive the world.

PERSONAL.

Mr. E. FEARON, Assistant and Chemist to Mr. C. B. Newton, Assoc.M.Inst.C.E., F.C.S., the Gas and Water Engineer to the Carlisle Corporation, has been appointed Chemist to the Gas Department of the Salford Corporation.

The will of Mr. CHARLES CLEMENT WALKER, J.P., head of the firm of Messrs. C. & W. Walker, of Donnington, who died at his seat, Lilleshall Old Hall, Newport, Salop, on the 4th of February, as recorded in our columns at the time, has been proved. The testator's personalty is sworn at £129,712 14s. 4d. gross, and £128,776 14s. 2d. net.

Mr. JOHN FAGG, of Quarry Bank, Tonbridge, has just been appointed Chairman of the Tonbridge Gas Company, in succession to Mr. John Collins, deceased. Mr. Fagg has been a Director since 1866, and is much esteemed by his colleagues. He is also Chairman of the Tonbridge Water Company, and has been on the directorate 22 years.

Mr. D. M. F. GASKIN, M.Inst.C.E., the President of the British Association of Water-Works Engineers, has decided to commence private practice in Liverpool. As Mr. Gaskin holds the position of Water Engineer of the Nottingham Corporation, an agreement has been come to between the Water Committee and himself whereby he has been relieved of the active and personal supervision of the water-works until the end of the year, when his connection with the undertaking will cease. In the meantime, his services will be available whenever the Committee require them.

It will be seen from the list of successful candidates at the last examinations in "Gas Manufacture" which appears in another part of the "JOURNAL," that Mr. J. H. CANNING and Mr. H. E. RILEY have both passed first class in the Honours Grade. The former is the son of Mr. Thomas Canning, Assoc. M.Inst.C.E., of Newport, whose paper read at the recent meeting of The Gas Institute appears in another column; and Mr. RILEY stands in similar relationship to Mr. E. C. Riley, of Swindon. We heartily congratulate both the candidates, who were trained under their fathers, upon their success.

Additional Capital for The Gaslight and Coke Company.—The Directors of The Gaslight and Coke Company have decided to issue £25,000 of "A" ordinary stock, and have instructed Mr. Alfred Richards to offer the same for public competition at the Mart, Tokenhouse Yard, on the 9th prox. This stock ranks for a standard dividend of 10 per cent. per annum, subject to the sliding-scale; but the last dividend thereon was at the rate of 12¾ per cent.

British Association of Water-Works Engineers.—The programme for the annual meeting of this Association has been issued by the Secretary (Mr. W. H. Brothers). The proceedings will commence next Tuesday at the Town Hall, Westminster, and will be continued there until mid-day Thursday. The first morning will be devoted to general business and the Inaugural Address of the incoming President (Mr. H. Ashton Hill, M.Inst. C.E.); and the afternoon, the following day, and Thursday morning, will be occupied with the reading and discussion of papers. These are distinctly varied in their subject-matter. Mr. W. Whitaker will describe "Some Middlesex Wells;" and Mr. T. N. Ritson will impart information as to "The Removal of Internal Corrosion from the Mains of the Kendal Water-Works." A paper will be contributed by Mr. W. Ingham on "The Torquay Water-Works;" and one by Mr. Alfred Towler on "Pumping Machinery." Mr. Walter G. Kent is down for a communication on "The 'Venturi' Meter in Relation to the Measurement of Water in Large Mains;" and Mr. W. Coles Finch promises an interesting statement on "The Use of an Electrical Recorder for the Detection of Waste and other Purposes." Mr. L. Holme Lewis will furnish an "Historical Sketch and Description of the Manchester Corporation Hydraulic Power Works;" and Mr. John Shaw some "Notes on Distribution." The annual dinner will take place at the Star and Garter Hotel, Richmond, on Tuesday evening. Thursday afternoon will be spent in visiting the Southwark and Vauxhall Water Company's works at Hampton; and on Friday an excursion is to be made to Windsor and Eton, including a trip up the Thames, the details for which are in the hands of Mr. C. Sainty, the Engineer of the Windsor Corporation Water-Works.

THE INCORPORATED GAS INSTITUTE.

PROCEEDINGS AT THE THIRTY-FOURTH ANNUAL GENERAL MEETING,

HELD AT

THE GUILDHALL, BATH, JUNE 15, 16, AND 17, 1897.

C. STAFFORD ELLERY, Esq., Assoc.M.Inst.C.E., President.

PAPERS AND DISCUSSIONS.

THE TAXATION OF GAS BY LOCAL AUTHORITIES.

By ISAAC CARR, of Widnes.

In presenting this paper, the author wishes it to be understood that he has written it purely and simply with the desire that it may be found of some utility to those interested in the subject treated, and with the hope that its consideration may not in any way lead to the vexatiousness which has occasionally characterized the discussion of this question in times gone by.

The question of the policy of municipal and other local authorities owning gas-works appropriating the profits arising therefrom for the relief of the general district and other rates, is one of such importance as to vitally affect the existence of the gas industry in the time to come. It must therefore be a question of the greatest importance to those who are engaged in the business of gas making. Notwithstanding its importance, however, it has never yet been discussed by the members of this Institute. It has been dealt with by District Associations, and has frequently formed the subject of articles and correspondence in the technical journals; but the only reference of importance which the author can find in the "Transactions" of the Institute is in 1881, when Mr. Charles Hunt, the President for that year, dealt with the subject at considerable length in his Inaugural Address. Mr. Hunt at that time not only warmly countenanced the taxation policy of municipalities, but further contended that the matter was not one of concern for the officials responsible for the management of gas-works. Among other things, he said:

> Now, I do not happen to be one of those who conceive it to be within the province of the officials to tender advice as to the disposal of gas profits. That is a matter which may be very safely left to the discretion of the representative bodies who are answerable to their constituents for their financial policy. Our chief, not to say sole duty, lies in the pursuit of means for the attainment of the most economical ends. Our satisfaction is derived from the achievement of results. It is our privilege to create—at all events in a very great measure—the situation from which it is the task of others to work out a more or less satisfactory deliverance.

And again:

> So remotely, however, does it concern us whether the object of the Corporation be to sell gas at cost price or to relieve the rates, that, in our official capacity, the course that appears to me to be most properly ours is one of non-intervention.

Whether or not Mr. Hunt intended the members to understand that the subject was, with his utterances, finally disposed of, the author is unable to say. The fact remains that, although the Council of the Institute have annually invited papers on this question of municipal management of gas-works, no one has, during the long intervening period, thought fit to re-open the subject. One inference of this apparent apathy is that the views so ably enunciated by Mr. Hunt have met with the general acceptance of the members, and that nothing more remains to be said.

The writer quite agrees with Mr. Hunt as to the chief duty of the gas manager, but not that it is his sole duty. Indeed, if he were not able to form, and at times to express, opinions on the fiscal policy of the department to which he belonged, he would in many cases be considered a very poor manager, and would find it greatly to his detriment. However, Mr. Hunt himself might modify his opinion considerably to-day, as the possibility of a close and keen competition was very much more problematical when he wrote his address than it is now; and on that ground alone the time is opportune for a further consideration of the subject. At any rate, it behoves the gas manager to see that the process he represents is not condemned as obsolete until all its resources have been exhausted. In order to bring this about, the industry must be standing on its merits, doing its best to make a good and cheap article, selling at such prices as will pay all its expenses and be a burden to no one, but a boon and a blessing to the whole of the community which it serves.

The only thing that ever could be said in extenuation of the marauding policy was that, gas lighting being a monopoly, there was no escape for the consumer, and that taxation could with impunity be enforced. But even granting for a moment that gas is an absolute and perpetual monopoly, and apart from all consideration of fairness to the consumer, the author contends that such a policy, even under such circumstances, is prejudicial to the best interests of any industrial community, and to the non-consumer as well as the consumer.

If gas were treated as a raw material, and sold at cost price, the returns, or benefits, accruing directly and indirectly to the non-gas-consuming property owner and householder would be greatly in excess of any relief they imagine they derive through keeping up the price and annexing the surplus for the rates. What would be the effect upon the country's industries if coal, iron, cotton, and other raw materials, had in some towns a tax imposed upon them for the relief of the district rate? If it be conceded that such an act would be prejudicial, then it must also be conceded that to tax gas is to limit its sphere of usefulness, and to proportionately stagnate trade. No amount of surplus gas profits ever yet appropriated is, in the writer's opinion, sufficient to compensate the inhabitants of a town for any dulness or restriction in trade. He remembers hearing Mr. F. H. Gossage (the head of the great firm of Messrs. William Gossage and Sons, Widnes) state in the presence of a number of gentlemen, mostly gas engineers, that at their Liverpool works they could get their materials direct from the ship into the works, and the manufactured article direct on to the ship again, at a minimum of cost; whereas at Widnes they were put to a considerable expense for lighterage, railway freight, and all its attendant wear and tear of rolling stock. Yet, notwithstanding all this, in consequence of the cheap supply of gas and water at Widnes, they could conduct their business there much more economically than they could at Liverpool. Messrs. Gossage and Sons being large employers of labour, does it not follow that the maintenance of this industry in the town is a benefit all round—to the owner of the cottage property, to the shopkeeper, to the tradesman, and to the merchant, all of whom are ratepayers; and even to other ratepayers who do not come into direct contact, owing to the greater distribution of the burden. It must therefore be repeated that, even if gas were secure in monopoly, the best interests of the general body of the ratepayers would be served by selling gas at cost price; and justice would at the same time be done to the consumer.

The foregoing observations will doubtless give rise to much diversity of opinion; but whatever views gas managers may have held in the past of the policy complained of, it is submitted that to-day they are confronted with a different state of affairs to that of former years, and that this subject demands reconsideration on the basis of an ordinary competitive industry. A stern and real competitor has to be faced—the successful and firmly-established rival, the electric light. In consequence of this competition, the much-vaunted gas monopoly is slipping gradually away. Is its departure to be hastened by continuing this unfair taxation?

The strides which electric science is making, together with the rapidity with which electricity is supplanting gas for lighting in the majority of large towns and cities, should be sufficient to make everyone who is in any way responsible for the future of the gas industry, pause and consider what is to be the outcome of it all. Can gas continue to bear this tax and maintain in the race its position of to-day? Whatever justification local authorities in the past may have considered they have had in taxing gas, it must be said that, in the face of the present great and rapidly increasing competition, that justification no longer exists.

Without taking a pessimistic view of the situation, it must be averred that the surest means of securing the future of our industry is to abandon this taxation, and to allow gas to fight its way free and untrammelled. If, however, this mistaken policy of profit appropriation be persisted in, it must be predicted that before many years

are over the customary increasing consumption will give place to decrease; and upon such an issue a debit balance will eventually be inevitable. To increase the price at such a juncture, as a means of retrieving the lost ground, would only defeat its own end, by driving the remaining gas consumers more rapidly over to electricity. If this stage of affairs be reached, then perforce must follow the abolition of the gas tax, after having been the means of inflicting irretrievable injury upon the industry.

It has been said that this matter is not one of concern for gas-works' officials. Whatever the feeling of the officials themselves may happen to be on this particular point, the question to ask is: Will the representative bodies, who are answerable to their constituents for their financial policy, step into the breach, and continue to allow the course of the officials to be one of non-intervention? The author ventures to think not. No; the officials will at such a crisis stand discredited, and be soundly rated for not having foreseen so calamitous an issue, and warning their committees in time to have enabled them to take the necessary steps to avoid the danger. Further, the hardship of such an event would be doubly cruel, in so much as the generations who had shared the spoils in the days of prosperity would have passed away, and the burden would fall entirely upon posterity.

A recent development in the taxation of gas is that some local administrators, not content with making roads, parks, and sewers, and building town halls, &c., have, on behalf of the ratepayers, possessed themselves of electricity works, many of which are not yet sufficiently developed to be remunerative. In one of the boroughs in the Midlands, the loss on electric lighting was equivalent to 3d. per 1000 cubic feet on the gas sold, which the unfortunate gas consumers had to pay. The day is, however, probably far distant when an electric light department will be found contributing 3d. per 1000 cubic feet to the gas department in order to cheapen the price of gas. It looks like the irony of fate that gas should be thus made to furnish the sinews of war for its own destruction.

This form of taxation is doubly unjust to many of the gas consumers. The large shopkeeper who takes the electric light into his place, does so principally for advertising purposes; and he uses it in order to draw customers away from the smaller shopkeepers in the back streets and suburban districts, who burn gas, and are obliged to pay 3d. per 1000 cubic feet more for it than would be otherwise necessary, in order that their rivals in the main street may be assisted to take away their trade.

It is a curious circumstance, as bearing on this particular form of taxation, that where a town is supplied with gas by a gas company and the corporation take up electric lighting, the corporation is not, as a rule, overburdened with success; and the same may be said of the electric light company who have opposed and competed with the gas company. But when local authorities who have never been able to rise beyond the stage of mediocrity in the management of their gas-works take up electric lighting as an auxiliary, they at once become the most brilliant of administrators.

There is an old aphorism to the effect that "custom makes slaves of us all;" and in trying to reconcile in his own mind why this system of confiscation of gas profits has obtained such general practice, the author has concluded that it must in a great measure be due to custom. The practice has been one that municipalities have greatly appreciated and enjoyed; and so long as they have been able to say that other people do it, no amount of argument or question of fairness to the gas consumer has deterred them from diving with both hands into the coffers of the gas departments.

It is encouraging, however, to know that there are, and have been for years past, many very notable exceptions to this policy. In Scotland, the general practice has been almost entirely the reverse to that in England. In a recent publication, entitled "The Story of Municipal Glasgow," Sir James Bell, Bart., the Lord Provost of Glasgow, in dealing with the policy of the Corporation in the management of its gas undertaking, after having alluded to gas distribution as possessing the nature of a general monopoly, goes on to say:

> Illuminating gas is an essential convenience of a modern civilized city; and the citizens are entitled to obtain it under the most convenient and least onerous conditions possible. . . . Nor have the Town Council of Glasgow been tempted to earn a profit from their gas industry whereby to foster other, but alien, objects. The man who burns gas in Glasgow and its suburbs is assured that he is thereby called on to pay for gas only, and not for palatial erections, for libraries or art galleries, nor for any other public object, however laudable and desirable. And yet the temptation to apply gas revenues to other than gas purposes was considerable; and the right was indisputable. The Town Council had the precedent and example of several English Municipalities in which surplus gas revenue is systematically applied to other public purposes. The Town Council, moreover, is supplying a widespread population with gas at a cost far below what these scattered communities could produce gas for themselves; and the city receives no benefit in return from these consumers. In the gas-rents, the Council had the means, and the right to secure and to divert substantial profits to such public purposes within the city as they might deem proper. But they have justly and prudently refrained from exercising their right; and the consumer's gas bill as nearly as practicable represents the cost of the illuminant as it is consumed.

Parliament has of late years also shown that it is by no means dead to this question of confiscation of gas profits, by restricting in this respect the powers of the Stalybridge and Mossley Corporations in their Acts of 1885 and the Oldham Corporation in their Act of 1886, whereby it is rendered impossible for these Corporations to inflict the injustice on the consumers and the injury to the industry to such an extent as is being practised by many local authorities represented by members of this Institute.

The Widnes Improvement Act of 1867 is one which does infinite credit to the discretion and foresight of the appellants of that day, inasmuch as clause 102 of the Act provides that the gas-works fund shall be applied as follows:—

1.—For paying the interest from time to time payable on moneys secured by gas-works mortgages.
2.—For setting apart the sinking fund for paying off the gas-works mortgages.
3.—For maintaining the gas-works, and in other respects carrying this Act into execution with respect to gas (except enlargements and extensions).
4.—For making the enlargements and extensions of the gas-works.
5.—For repaying moneys advanced for purposes of this Act with respect to gas out of the general district rate, and not repaid.
6.—For paying off the principal moneys secured by gas-works mortgages.
7.—The surplus from time to time shall be carried to the general district fund of the Local Board, and be applicable accordingly.

From the foregoing it will be seen that, until the whole of the debt on the works is extinguished, no profits can be appropriated for the relief of the rates.

It will be within the memory of many members that the Widnes Corporation in November of last year petitioned the Local Government Board to sanction an application to Parliament for an amendment of this Act, which amendment was to render the surplus funds of the gas department applicable for appropriation to the general district rate of the borough. It may be stated here that a few years ago the Corporation commenced to pay for the public lighting of the borough out of the gas profits—an action which is directly contrary to the true meaning of the Act. Not content with this, they decided to advance a step further; hence the application.

The evidence given for the Corporation before the Local Government Board was briefly to the effect that the Town Council desired to have extended to them the same privilege enjoyed by other local authorities owning gas-works, so that they might, "should they so wish," appropriate the surplus gas profits for the relief of the rates. It was at the same time strongly contended for the Corporation that this application, if granted, was not in any way intended to prejudice the interests of the gas consumers by raising the price of gas; but what they wanted only was to be free of the irksome clauses, for, as some members stated, it made it look as though they could not be trusted.

The Local Government Board, however, promptly refused the application, doubtless having in view the extent to which this privilege is being abused in other towns, where taxes varying from 2d. to 1s. 2d. per 1000 cubic feet of gas sold are being imposed—an imposition which Parliament would never, at the present day, permit a gas company to have the power to inflict; so that in many towns the consumers would have been much better off had they been left to the tender mercies of gas companies. Sunderland, Newcastle-on-Tyne, and Plymouth may be mentioned as examples of what gas companies can do for their consumers in the way of selling cheap gas.

Probably the author will be told that he is wanting in consideration for the ratepayers, who have their property mortgaged for the debt upon the gas-works, and the additional advantage afforded to the gas consumers through having their loans raised at a low rate of interest in consequence of this security. In an address delivered to the Manchester District Institution of Gas Engineers in February last year, he dealt with this part of the question at some length, and is therefore not now disposed to occupy time by reiterating his remarks on that occasion further than to say that experience teaches that, in effect, this liability is imaginary and not real. Where is there a town where ratepayers have been called upon to make up the deficiency of a gas-works account in any other form than by a loan to meet some sudden and temporary difficulty? That is to say, a case where money has been advanced out of the pockets of the ratepayers, and the capital and interest to the last penny not repaid. The writer does not know of a single instance where the ratepayers have been permanently out of pocket through having been possessors of their own gas-works. This never has been the case, and he believes never will be if the policy which he is advocating to-day be adopted.

Few places afford a better example of its advantageous effect than does Widnes, where, in a period of twelve years, the price of gas has been reduced from 3s. 6d. to 1s. 8d. and 1s. 10d. per 1000 cubic feet, and the consumption increased from 61 to 183 millions per annum, and the number of consumers from 700 to 4370, out of a total of 5760 houses. Further, the amount of surplus profit last year is in excess of that of any previous year; and a recent reduction in price to 1s. 6d. and 1s. 8d. per 1000 cubic feet has already brought about a further increase in consumption of over 20 per cent., which, if it be maintained through the year, will leave the surplus profit practically the same, in which case the author trusts his Committee will see their way to recommend a still further reduction in price.

The time has now arrived when the urgency of competition demands that the fetters of taxation should be cast off, and gas permitted to fight its way on its merits. This being done, a great and certain future of usefulness and prosperity for the gas industry will be assured.

IS THE MUNICIPALIZATION OF GAS UNDERTAKINGS ADVANTAGEOUS?

By Herbert Lees, of Hexham.

The municipalization of gas undertakings is a subject that has not entirely escaped the attention of this Institute; but the papers which have hitherto been devoted to the question have dealt mainly, if not exclusively, with the principles that govern the transfer of gas undertakings to local authorities. The subsequent discussions have not always been confined within these limits; and enough has been said to indicate that an opportunity of debating the broader question of the advantages and disadvantages of municipalization, would not be unwelcome.

There are, however, other and more important reasons why this phase of the question should not be overlooked. The practice of transferring gas undertakings to local authorities has been going on, to a greater or less extent, for a considerable number of years; and within the last quarter of a century, a large proportion of the works now owned by local authorities have been so transferred. There has, therefore, been ample time in which to watch the results and to make comparison, so as to form a judgment upon this policy. During that period, an evolutionary process has been at work which has wrought great changes in the economic conditions of gas supply. Under these circumstances, it will probably not be considered inopportune to discuss the question in the light of present-day conditions and requirements, with a view to ascertaining if a continuance of the policy is for the general good.

Municipalization in a general sense is only the application of a principle in local affairs which the Socialist would make national; the nationalization of railways and all industries is part of the same programme. This is logical enough; and the arguments in favour of one serve also for the other. The difference is one of degree and detail only. Why should a tram service be municipalized, and cabs and other vehicles be left to private enterprise? And if the supply of artificial light, and one particular mode of transit is—for the supposed welfare of the citizens—in the hands of the local authority, why should such important commodities as milk, flour, clothing, and other necessaries of life, be left to the individual? The theory, if applicable to the former, is equally so to the latter. The answer to these questions may be that it is expedient to proceed by steps, slowly. But this reply admits, by inference, that the principle is sound; and yet there are many who approve the policy of municipalizing gas undertakings who would shrink from the idea of ever applying it to the provision of food and clothing for the community, though it must be admitted that these commodities are more essential than any particular form of artificial light. If it is advantageous that one should be under the direct control of the municipality, the transfer of the other should be beneficial to an equal degree. It has not, however, been conclusively demonstrated that the theory of Collectivism is sound in practice.

The argument that gas is a public necessity is not a conclusive one, though it is frequently used. This may be said of water, without fear of contradiction. Water has no substitute. Gas, however, occupies a different position. There are rivals in the field, which not only refute this argument, but go a long way towards breaking down the contention that gas companies enjoy a monopoly of lighting. True, gas companies have not suffered by the competition of rivals; but the fact that there is choice of illuminants and of heating and motive power, is a safeguard to the public against undue advantage being taken.

Then there is this question of monopoly. There is no such thing as a monopoly of lighting in these days. In most large towns, the electric light is available; and everywhere the gas undertaking has to compete with the petroleum oil vendor for a share of the lighting. If the majority elect to use gas, it is owing to its superiority in regard to quality, convenience, or price. But apart from this, a very strong argument against municipalization is to be found in the various Acts of Parliament (Public and Private) which have been enacted to create and control this monopoly of supplying gas to a community.

It is also urged "that the supply of a commodity necessitating frequent interference with the public thoroughfares should be in the hands of the public authority having charge of those thoroughfares, and not of private individuals." This is an argument that has been considerably weakened within recent years; and at no time since the passing of the Gas-Works Clauses Act of 1847, can it be said to have had very much weight. Probably no gas company of moderate dimensions have their mains confined within the limits of the district of one particular public authority; and since the county councils have taken over a considerable portion of the main roads and streets of most towns, the case has become more complicated. It is quite evident that municipalization could only partially remove what is claimed to be a grievance in this respect. Moreover, ample provision is made for protecting the interests of local authorities in the Gas-Works Clauses Act of 1847, in which clauses are introduced to give the local authority adequate control of the traffic during the breaking up of streets, and which entail upon the gas company the necessity of reinstatement. Failing this, the company are subject to penalties; and the local authority have power to do the work and charge the cost to the company. It is not claimed that a local authority could obviate the necessity for breaking up the streets; and it will probably be admitted that these provisions are sufficiently stringent, and are much more likely to be adhered to by a gas company with a local authority acting as "policeman," than if the latter were a law unto itself in these matters. It would not be difficult to give specific instances in proof of this; but members will doubtless be able to supply cases from personal experience.

Perhaps the most plausible claim that is set forth as one of the advantages of municipalization is that local authorities can, owing to the security of public rates, raise money at a cheaper rate than gas companies. The days of 10 per cent. dividends have long since passed away; and only those shareholders who were fortunate enough to secure their shares when gas property was considered a very risky investment, and have had sufficient courage and foresight to hold on to them, can now rejoice in such returns. Their number must be very small indeed; and probably there are few who would wish to deprive them of a well-earned reward. But, in any case of transfer, these shares would

have a value commensurate with the rate of dividend paid upon them. At a later period Parliament reduced the maximum dividend allowed to 7 per cent.; and this was followed by the introduction of the auction clauses and the sliding-scale; while still more recently, several companies have consolidated their stock to, and issue all new capital to carry, a 5 per cent. maximum dividend, to which the auction clauses also apply.

In the case of the South Metropolitan Gas Company, the standard dividend for the sliding-scale was fixed at 4 per cent.; and the author is indebted to Mr. George Livesey for the information that this Company are able to raise all new capital, in certain fixed proportions of share and loan, at an average rate well under 3½ per cent. Several gas companies in the North of England are able to issue share capital at 4 per cent. and under, and loan capital at 3 to 3¼ per cent., so that the average does not amount to more than 3¾ per cent. on the total amount raised; and many other companies can acquire capital on equally good terms. This is a very different state of things to what obtained at the period when gas companies issued all their capital to shareholders at par. Under those circumstances, there was a fair margin between the rate at which capital could be raised by local authorities and gas companies. But the difference now does not amount to more than 15s. per cent.; and this is more than swallowed up by the repayment of principal which has to be borne by gas consumers under local authorities. The shareholders take all the risk with regard to capital under a company; while the ratepayers are supposed to do it under a local authority. In actual practice, the gas consumer not only provides the interest on capital borrowed, but also the necessary repayments for clearing off the loan within a certain period; and for this "privilege," he is taxed in some cases to the extent of from 6d. to 10d. per 1000 cubic feet. This question is one of so much importance to the consumer, that it cannot be too strongly emphasized that municipalization is not to his advantage.

This raises the question of the right of local authorities to appropriate the profits of their gas undertakings in relief of the rates. They do so apply them; and so long as the law permits it, they will continue to do so. In Scotland, it is illegal; but in only one or two cases in England is it either restricted or forbidden.

The most potent factor for municipalization, will probably be found to be in this desire to appropriate the profits; and while the author does not intend to discuss the equity of this policy—inasmuch as it will be dealt with in another paper—he feels he cannot entirely ignore the question. In order to give force to this point in an agitation for acquiring a gas undertaking, it is usual to assume that "consumer" and "ratepayer" are synonymous terms. But such is not the case. The ratepayers form a separate and distinct class from the consumers; and their respective interests may be entirely opposed to each other. Every consumer may be, and probably is, a ratepayer; but it is a fact that in a good many cases the large consumer of gas is assessed at a comparatively small rateable value. Take a person with an industrial establishment, in which the use of gas for motive power or for other business purposes is extensive, while the rateable value of his premises is small. It is of the utmost importance to him to have gas at as cheap a rate as possible; and if the municipalization of the gas undertaking means keeping up the price of gas to relieve the rates, he is decidedly the loser by the transaction. This is not an imaginary case, nor yet an isolated one.

Then the ratepayer is not necessarily a gas consumer. Owners of extensive cottage property as a rule compound for the payment of rates, and fix the rent to cover this. It is not usually the case that a reduction in the rates has any influence upon the rent. Not unfrequently this gentleman resides out of the town, and consumes no gas at all. The subsidization of the rates by the gas undertaking is one of the dearest wishes of his heart. The extension of the penny-in-the-slot system of supplying gas, will make this distinction more apparent. The result is that his tenants are not only paying the rates in the rent, but as consumers of gas under a local authority they are handing over a bonus to the landlord.

And, again, there is the proprietor of the large and flourishing business establishment in the principal street of the town, where the electric light has been introduced—not because it is cheaper, but because it is one method of advertising his business, to the disadvantage of his neighbour whose banking account is in a less flourishing condition. The proprietor of the less imposing establishment finds it necessary to do something to counteract the influence of the electric light; and he launches out into further expense in gas lighting—not daring to venture on the electric light, lest the cost should be too much for him. He succeeds wonderfully well; and then he is chagrined to find that he is helping to pay for his rival's illuminant. It so happens that both the gas and electric light undertakings are under the local authority; and the profits of the former have been taken to subsidize the rates to the extent of 6d. in the pound. The electric light department has sustained a loss, which is thrown upon the town, and is equal to 3d. in the pound on the rates. This is no mythical illustration. Further, there are in many towns a large proportion of ratepayers who, for various reasons, do not consume gas. It is evident, therefore, that consumer and ratepayer are not synonymous terms; and it is well to keep this in mind when discussing a question of this character.

A study of the parliamentary returns relating to gas undertakings, may help to throw some light on the relative amount required to pay the dividends of companies and the interest and sinking fund of local authorities, as well as the price of gas, &c. The following statistics, embodied in Appendix A, where the particulars are set out more fully, have been taken from the returns for the year ending Dec. 31, 1895, and March 25, 1896, for companies and local authorities respectively.

TABLE I., *being an Extract from Appendix A* [*p.* 96.]

	United Kingdom.				Six Northern Counties of England.			
Per 1000 Cubic Feet of Gas Sold.	Local Authorities.		Companies.		Local Authorities.		Companies.	
	£ s. d.		£ s. d.		£ s. d.		£ s. d.	
Total capital paid up	0 12	7·97	0 12	8·82	0 12	9·77	0 12	4·88
Total receipts	0 3	2·42	0 3	7·89	0 3	0·96	0 3	0·94
Total expenditure	0 2	4·95	0 2	8·09	0 2	3·07	0 2	2·84
Gross profit	0 0	9·47	0 0	11·80	0 0	9·89	0 0	10·10
Gross profit, per cent on total capital paid up	6 4	7·00	7 14	7·00	6 8	5·00	6 15	8·00

It will be seen from the above table that, if the whole of the United Kingdom be taken, the comparison tells against the companies; but there are several disturbing influences which must be taken into account. In the first place, a considerable proportion of the companies' capital was raised in the "old days," when shares were issued at par; and many of the local authorities acquired their undertakings when such property was much less valuable than it is to-day. These remarks apply to all the comparisons made. Then it must not be overlooked that nearly the whole of the works owned by local authorities in England are in the Midlands and the North, within easy reach of an excellent supply of coal. The author has taken account of this factor, and compared the northern counties separately and collectively; and the result is something like what might be expected. The area of the six northern counties will probably be considered sufficiently wide for making an accurate comparison; while it also presents equality of conditions. The local authorities and companies in the whole of that district show practically the same results under each heading.

Dealing with the counties separately (the details of which will be found in Appendix A), Durham shows that the revenue per 1000 cubic feet of gas sold is much the same in both cases; while in expenditure, the companies have a slight advantage, and take the extra profit as dividend, though the rate per cent. is less than that of the local authorities, owing to the former having a heavier capital account. Lancashire shows the results to be in favour of the local authorities; Yorkshire is an argument in favour of company administration; Northumberland—in which there are no gas undertakings owned by local authorities—gives better figures on behalf of companies than any of the other counties.

The amount of profits appropriated for rates by local authorities in the six northern counties was 2·36d. per 1000 cubic feet of gas sold. If, therefore, the undertakings that have been acquired years ago can only do this when charging the same price for gas as companies in the same

district, and under similar conditions, is it probable that, if purchased at the present time, they would be able to serve the consumers as well as the companies they would supersede? Some further and more recently published statistics throw additional light upon this aspect of the question.

TABLE II., *being a Summary of Appendix B.*

Per 1000 Cubic Feet of Gas Sold.	Companies.	Local Authorities.	Credit Companies with Difference.	Credit Local Authorities with Difference.
	s. d.	s. d.	d.	d.
Revenue from gas .	2 8·424	2 7·285	..	1·139
Cost of coal . . .	1 3·777	1 1·203	2·574	..
Amount required for interest and sinking fund or for dividend	0 10·880	0 9·227	..	1·653
Deduct companies' credit			2·574	2·792
			..	2·574
Net credit to local authorities			..	0·218

In the above table, it will be seen that the price of coal has been taken into account; and this will correct two disturbing factors—namely, the relative position of works to the coal fields, and the quality of gas supplied. The net result is that the companies can pay their maximum dividends and interest on loans—after making this correction for cost of coal—with only 0·218d. per 1000 cubic feet of gas sold more than it takes to pay interest and sinking fund charges of the local authorities.

This surely disposes of the contention that there is any material advantage in the claim put forth for local authorities in being able to raise capital at a considerably reduced rate as compared with gas companies. The slight advantage that is shown in this respect is almost entirely sacrificed in some other way; and, again, in this comparison it must not be forgotten that the works of some of the local authorities included in Appendix B were acquired upwards of forty years ago (the most recent transfer took place nearly twenty years ago), and the amount required to pay interest and sinking fund on some of the earlier transfers is very low, and greatly reduces the average. Others require much more than the average of the company's costs to meet these charges. These results also disprove the claim that municipalization brings about a reduction in the cost of working, owing to the abolition of directors' fees and the reduction of office expenses.

One of the advantages of company administration is to be found in a continuity of policy, owing to the fact that changes of the directorate are seldom made, and that the interests of the Board are purely and simply the welfare of the undertaking; and this is inseparably bound up with the consumers' interests. In the case of a gas committee, the circumstances are widely different. Changes are frequently taking place in the *personnel* of the council and of the gas committee; and the policy of a new member may have (and often has) been formulated when before the electors on entirely erroneous data, or perhaps no data at all. It is not easy for a public man to retract from a position once adopted in this manner; and he is likely to fall into the position of a delegate elected to vote for a certain policy, whether it be for the good of the department or not. Moreover, the question of personal interest in the undertaking is absent; and—human nature being what it is—this is a factor that must not be entirely ignored.

So far the statistics given have been involved with a number of undertakings acquired nearly half a century ago; and it might be well to apply the deductions obtained to a hypothetical case of transfer at the present time. Taking Table II. as the basis of calculation, and an undertaking selling 500 million cubic feet of gas per annum, the annual profits would be—

Thousand cubic feet.
500,000 × 10·880d. = £22,667.

This sum capitalized at 25, 26, 27, 28, 29, and 30 years' purchase respectively, would give capital accounts as follows:—

C.	25	years' purchase	= £566,675
D.	26	,, ,,	= 589,342
E.	27	,, ,,	= 612,009
F.	28	,, ,,	= 634,676
G.	29	,, ,,	= 657,343
H.	30	,, ,,	= 680,010

APPENDIX A.—*Comparative Statistics relating to Gas Undertakings Owned by Local Authorities and Companies respectively.*

District.	Owners.	Capital Paid Up.		Receipts.		Expenditure.		Profit.		Gross Profit Per Cent. on Capital Paid Up.	Profits Appropriated by Local Authorities in Relief of Rates.		Gas Sold.		Number of Undertakings.
		Total.	Per 1000 Cub. Ft. Sold.	Total.	Per 1000 Cub. Ft. Sold.	Total.	Per 1000 Cub. Ft. Sold.	Gross.	Per 1000 Cub. Ft. Sold.		Total.	Per 1000 Cub. Ft. Sold.	Total.	Per Undertaking.	
		£	s. d.	£	s. d.	£	s. d.	£	d.	£ s. d.	£	d.	Cub. Ft.	Cub. Ft.	
UNITED KINGDOM. . .	Local Authorities . .	25,624,326	12 7·97	6,478,191	3 2·42	4,881,944	2 4·95	1,596,247	9·47	6 4 7	..	..	40,465,831,000	199,339,000	203
	Companies	45,195,416	12 8·82	12,982,956	3 7·89	9,491,344	2 8·09	3,491,612	11·80	7 14 7	..	..	70,977,871,000	165,452,000	429
DURHAM.	Local Authorities . .	272,835	10 8·87	73,680	2 10·78	53,282	2 1·16	20,398	9·62	7 9 6	8,482	4·00	508,083,000	169,361,000	3
	Companies	1,113,670	13 10·44	232,667	2 10·71	162,898	2 0·34	69,796	10·37	6 5 3			1,605,844,000	178,427,000	9
LANCASHIRE	Local Authorities . .	8,135,448	13 11·91	1,856,112	3 2·31	1,345,592	2 3·77	510,520	10·54	6 5 6	130,956	2·70	11,627,843,000	290,696,000	40
	Companies	3,334,988	14 2·00	857,333	3 7·69	657,279	2 9·50	200,054	10·19	6 0 0			4,708,947,000	162,377,000	29
YORKSHIRE	Local Authorities . .	3,870,563	11 1·26	1,007,982	2 10·69	753,959	2 1·95	254,023	8·74	6 11 3	46,170	1·58	6,973,655,000	249,059,000	28
	Companies	3,271,517	11 11·37	808,769	2 10·31	563,603	1 11·91	245,166	10·40	7 9 7			5,655,736,000	97,513,000	58
NORTHUMBERLAND . . .	Companies	1,152,602	9 9·89	302,750	2 6·97	216,460	1 10·14	86,290	8·83	7 9 9	..	..	2,346,345,000	391,057,000	6
SIX NORTHERN COUNTIES	Local Authorities . .	12,521,407	12 9·77	3,009,705	3 0·96	2,204,858	2 3·07	804,847	9·89	6 8 5	192,477	2·36	19,543,064,000	250,552,000	78
	Companies	8,900,374	12 4·88	2,208,476	3 0·94	1,604,459	2 2·84	604,017	10·10	6 15 8			14,346,675,000	137,949,000	104

The amount required to pay interest on borrowed capital and sinking fund for the year ending March 25, 1896, by the whole of the local authorities owning gas-works in the United Kingdom was equal to 4·39 per cent. on the total amount borrowed. Applying this to the respective capital accounts as set forth above, the following sums would be necessary to pay interest and sinking fund each year:—

Capital Account.	Amount Required to Pay Interest and Sinking Fund.	
	Total.	Per 1000 Cubic Feet Sold.
C.—£566,675 at 4·39 per cent. . . .	£24,877	11·941d.
D.—£589,342 „ „ . . .	25,872	12·418
E.—£612,009 „ „ . . .	26,867	12·896
F.—£634,676 „ „ . . .	27,862	13·373
G.—£657,343 „ „ . . .	28,857	13·850
H.—£680,010 „ „ . . .	29,852	14·328

The increased amount, as compared with the company, per 1000 cubic feet of gas sold required to pay interest on capital and the sum set aside for repayment, varies from 1·061d. on the 25 years', to 2·493d. on the 28 years', and 3·448d. on the 30 years' purchase schemes respectively. Nothing has been added to capital account for parliamentary and other expenses of transfer; only the bare purchase price having been taken in each case.

It must, of course, be admitted that it is not impossible to cite isolated cases to show a result contrary to what is here set forth; but just as "one swallow does not make a summer," neither does the quotation of a single instance disprove an argument based upon results of so wide a character. There are gas undertakings that would be administered to better advantage under the control of almost any body of men rather than the present proprietors; and works of this character are to be found both among companies and local authorities. But happily they are the exception.

This much seems clear therefore—that consumers are placed at a disadvantage by municipalization; and if the ratepayers are to have any subsidy from the profits of an undertaking, it must be at the further expense of the consumers. And after all this is probably the strongest incentive for the acquisition of gas undertakings by local authorities. However, it must be placed among the disadvantages of municipalization. It is even doubtful whether the ratepayers benefit in a degree commensurate with the profits appropriated. Sir H. H. Fowler, M.P., when speaking at a municipal function at Wolverhampton in November, 1895, made some remarks which are particularly appropriate in this connection.* He said: "When local authorities discussed certain classes of expenditure, they were apt to think 'Government will pay half, and we need only consider how to meet the other half.' This was a very natural view to take. But he held to the doctrine that the power which spent the money should have the responsibility and the discomfort, it might be, of raising it. Nothing promoted economy, whether in public or private affairs, so much as the knowledge of the spender that he would have to find the money." Read for "Government," "Gas Department," and the sentence is eminently applicable to the question under consideration.

A further disadvantage under which the consumers are placed by municipalization is the removal, to a very large extent, of all independent supervision with regard to the illuminating power and purity of the gas supplied. This is considered to be a matter of great importance when the works are under a company; and there can be no doubt that consumers are fully entitled to the protection provided by Parliament in this respect. But the fact cannot be ignored that, when a transfer takes place, the Act becomes practically obsolete in the majority of cases.

It has been suggested, in reference to the transfer of the London Companies to the County Council or to a new London Municipality, that such a proceeding would "at least help to place a few gas-testers among the unemployed;" and that "that inquisitive instrument, the portable photometer, would be put away in a back yard somewhere, and forgotten." We know this, however, that local authorities having control of gas undertakings are not subject to the same strict supervision that is applied to gas companies.

One of the claims put forth by the Socialist for municipalization, is that work should be found for the unemployed. This is either based on the assumption that gas companies' works are under-manned, or that a local authority's works will bear the strain of any amount of additional expenditure. The former assumption has no foundation in fact; and the only way of meeting the latter position is to raise the price of gas. From time to time attempts have been made to enforce this doctrine. In some cases (not in all), they have been successfully resisted; but it must be admitted that the manager's position has been made more difficult from the fact that members of his council, and probably of his committee, have openly encouraged the workmen to make demands that are unreasonable. It may be said, to the credit of the majority of members of public bodies, that they do not sympathize with this sort of thing; but a numerically unimportant minority can do much harm under circumstances of this character. Labour troubles occur more or less in all works; but in such circumstances the manager of a company's undertaking can always depend upon his directors' support and sympathy.

There is no intention to enumerate the difficulties under which managers occasionally suffer, when the conflicting elements of a public body baffle their efforts. It would be unfortunate if the discussion of this question should drift in that direction. Suffice it to say that, where they do exist, it is to the disadvantage of the undertaking. "No man does good work with a heavy, discouraged heart—as well expect an artist to achieve a masterpiece in a foggy November. Atmosphere always counts for something."

* See "JOURNAL," Vol. LXVI., p. 1017.

APPENDIX B.—*Statistics relating to the Price Charged for Gas, Cost of Coal, and Amount Paid as Interest on Capital.*

COMPANIES.					LOCAL AUTHORITIES.				
—	Cost of Coal per Ton.	Cost of Coal per 1000 Cubic Feet Sold.	Revenue from Gas per 1000 Cubic Feet Sold.	Amount required for Dividends and Interest on Loans per 1000 Cubic Feet Sold.	—	Cost of Coal per Ton.	Cost of Coal per 1000 Cubic Feet Sold.	Revenue from Gas per 1000 Cubic Feet Sold.	Amount required to pay Interest and Sinking Fund per 1000 Cubic Feet Sold.
	s. d.	s. d.	s. d.	s. d.		s. d.	s. d.	s. d.	s. d.
1	7 10·586	0 9·628	2 0·880	0 9·625	13	12 3·209	1 3·154	2 4·405	0 3·210
2	7 3·634	0 9·498	1 8·543	0 8·290	14	8 8·645	0 11·739	2 3·153	0 6·396
3	14 5·613	1 5·399	2 9·993	0 8·852	15	10 0·228	0 10·812	2 8·285	0 11·207
4	14 1·591	1 3·752	2 10·918	1 0·831	16	9 9·498	1 0·069	2 5·021	0 7·613
5	18 0·207	1 9·637	3 2·315	1 0·038	17	8 6·871	0 11·402	2 11·358	0 9·009
6	14 6·308	1 7·006	3 0·670	1 4·321	18	10 7·111	1 1·141	2 7·701	1 1·844
7	14 0·091	1 2·142	2 11·618	0 10·840	19	10 6·261	1 0·938	2 6·459	0 6·649
8	13 7·449	1 4·614	2 9·009	1 0·477	20	11 7·906	1 2·733	3 2·621	1 3·842
9	16 10·731	1 6·895	2 9·569	0 7·581	21	10 7·074	1 0·699	1 11·071	0 4·452
10	10 1·234	1 2·219	2 6·678	0 9·007	22	10 10·330	1 1·625	2 3·240	0 3·859
11	12 9·278	1 4·498	2 7·385	0 8·932	23	11 0·885	1 3·141	3 1·562	0 11·490
12	12 10·580	1 4·036	2 11·508	1 1·766	24	12 10·758	1 2·283	2 8·285	0 11·628
					25	10 6·775	1 0·513	2 4·867	0 9·478
					26	8 3·052	0 11·817	2 7·807	0 10·445
					27	12 0·737	1 3·735	2 4·442	0 9·096
					28	10 6·235	1 1·447	3 2·274	1 1·423
Average per undertaking.	13 0·608	1 3·777	2 8·424	0 10·880	Average per undertaking.	10 6·723	1 1·203	2 7·285	0 9·227

Discussion.

Mr. S. Y. Shoubridge (Sydenham) said the Institute was to be congratulated on having presented to it two papers of such an able character as those to which they had just listened. As one who had served a Corporation for a number of years, he could bear testimony to the truth of a great deal of what had been advanced both by Mr. Carr and Mr. Lees. There could be no two opinions that there was a great temptation to all corporations to tax the gas consumer for the benefit of the rates, and that this policy was not the right one. He only wished that, instead of the papers being read there, they were being read to gas committees of corporations owning gas-works. A great man once said: "We should educate our masters;" but there might be some doubt whether it was wise for officials to intervene in questions of this sort. On reflection, however, they must see that, as they were in the position of advisers to the various authorities whom they served, they must have a great deal of influence; and it was very desirable they should hold clear and distinct views on this question, and exert a moderating influence on the tendency to keep up the price of gas, and so tax the gas consumers in order to subsidize electric light undertakings, or for other purposes.

Mr. Henry Tobey (Malton) said this matter had been brought before them from two different points of view—that of a corporation gas engineer and a gas company's engineer—but they were pretty well in agreement with each other. There was a great inducement at the present time to local authorities to speculate in acquiring gas and water undertakings, on account of the low rate at which money could now be raised on the security of the town. Mr. Lees, however, had pointed out that the difference in the rate at which companies could raise money under their Acts, and that at which local authorities raised it, was not so very great after all—only about ¾ per cent. This did not appear very much taken by itself; but when looked at in the aggregate, it was a different thing altogether. The money invested by local authorities in gas-works was more than £25,000,000; and ¾ per cent. on this came to about £187,000, which was not a bad item to save. There was a claim on the part of local authorities that they could serve gas consumers better than companies; that they were free from that grasping rapacity and extortion which they attributed to the companies; and that consumers could be served at a lower rate. But if they were going to place such a price on the gas as would bring in a profit which they could apply to municipal undertakings, one did not see exactly where the advantages to the consumer came in. They based their claim on the fact that they found the money. So they did in one way; but it was not out of their own pockets. Really all they did was to give collateral security. The consumer of the gas paid the interest, and in course of time the principal; and looking at it a little farther, it would be seen that the consumer was, year by year, making a present to the town of a very valuable property in the shape of the gas-works. The risk was very small after the first year or two; but he did not think any local authority had suffered much by acquiring gas or water works. He did not quite agree with Mr. Lees in some of his arguments; for he did not see the analogy between supplying gas and food. Mr. Lees said that both things were necessaries. This was quite true; but the conditions regulating the supply of gas did not at all apply to food. Suppose someone in Bath had the monopoly of supplying plain bread, but left to all outsiders the supply of cakes, buns, and tarts, he would be in an analogous position to the vendor of gas, who had the monopoly of the supply of the main illuminant. If Mr. Lees resided in Bath, and suffered a little extortion on the part of the man who had the monopoly of supplying bread, he would consider it a hardship, and would no doubt kick against it, much in the same manner as consumers sometimes resented the monopoly of gas suppliers. Mr. Carr remarked that he did not know of any cases where local authorities suffered from the acquisition of the gas-works. But notwithstanding what he had already said, there were instances in which considerable aid had been given from the general district rate to keep the gas-works running; and he might mention one or two. At Teignmouth, the district rate was called in to aid the revenue from the gas-works, in order that the principal money might be repaid. He could also mention a small town in South Yorkshire, where the district rate was taxed to the extent of £500 to make up the deficiency in the gas revenue. It might be suggested that they ought to raise the price of gas; but it was not expedient to do so, as the price was already 3s. 8d. per 1000 cubic feet. If they did increase the price, probably it would make matters worse. There was a town in his own neighbourhood which recently acquired the gas-works. They supplied 20 million cubic feet per annum; and the price was 2s. 11d. They found that, to meet the repayment of principal and interest, they would have to raise the price 5d.—viz., to 3s. 4d. per 1000 cubic feet—and in addition to this, they would have to put 2d. on the general district rate. Of course, these were only instances of small towns, and did not apply to large cities and boroughs. But there were a number of such cases. They should be a warning to small governing bodies not to burn their fingers by meddling with gas undertakings.

Mr. Percy Griffith (London) said he had been interested in the subject of the purchase of undertakings, principally in connection with water supply; but his investigations had brought him to conclusions very similar to those Mr. Lees had advanced. As a consulting engineer, he had been able to get a little more comprehensive view of the subject than would have been possible had he been a manager confined to one works, or even with experience extending over a long series of years, including two or three different works. He might also claim to have approached the subject from an entirely impartial standpoint. To an engineer whose employers were the local authority, it would be an invidious task to speak in any sense derogatory of his employers, either in particular or in general. In passing, he might observe that Mr. Carr had been bold enough to criticize the action of his Gas Committee; but they were not all equally courageous. He could not go far into detail with regard to Mr. Lees' paper, but wished to strongly confirm the conclusions he had come to, so far as his own experience went. As to water supply, the principal result of his own investigations into the subject was that water-works had not been managed by local authorities—at any rate in the majority of cases—with anything like financial success. They had almost invariably (at least among the smaller towns) charged a proportion of their expenditure on the general rates. Of course, this proceeding was more justifiable in the case of water-works than in that of gas-works. It had been stated that gas was not a public necessity; and the last speaker made a remark which emphasized this strongly. He quoted a case where a small local authority, who were in the position of having to supplement the deficiency in their gas revenue from the general rates, would naturally have liked to increase the price of gas, but were not able to do so, because it would have lost them consumers. This showed conclusively that gas was not a monopoly. If one lost custom by increasing the price, the monopoly was in name only. Mr. Lees had emphasized a point with regard to the raising of capital by local authorities which was worthy of close attention by all gas managers, because, though it was not a matter for which they were directly responsible, still, acting as they did as advisers of their clients, they were consulted on such matters, and their advice would be likely to have considerable influence, even if it was not at once accepted. The advisability of gas managers uniting to deal with a subject like this, was obvious. Everyone present appreciated the difficulty which he, as an individual, might have in conveying a complicated and difficult argument to the minds of his committee or board; but if all combined in expressing a united opinion on the subject, there was some probability that their clients would listen to what was said, and pay more attention to it. The particular point which Mr. Lees brought out most clearly, with regard to capital, was that local authorities could not raise money much cheaper than companies. He wished personally to thank him for so doing, because he was investigating the same subject in connection with water-works, and found that statistics were not available to furnish him with the information he desired. The facts given here from official statistics relating to gas-works were, however, sufficiently clear for the purpose. First of all, he came to the conclusion that the difference in the rate at which money could be borrowed by local authorities and public companies was very much smaller than was usually reckoned—namely, about ¾ per cent. Further, he carried this into a calculation on the basis of the price per 1000 cubic feet, which brought it out at 0·218d.—a difference so small

that the usual statement that local authorities were at a great advantage in this respect was certainly shown to be erroneous. There was a side issue which had not been mentioned—namely, the question of back dividends. With many men who were working on behalf of local authority undertakings in opposition to companies in connection with purchases, this was a very favourite argument. He had often heard it advanced before Parliamentary Committees; and it should be attended to. But in doing so, he thought it would be found to be of a somewhat vaporous nature. He should like to know if there were any representatives of companies present who had paid back dividends to any appreciable extent. They knew that a small company had some difficulty in paying dividends during their earlier years, or paid a very small dividend at first, and did not reach the statutory maximum for 8, 10, or perhaps 15 years. There was no doubt that, under the Acts of Parliament, there was generally power to pay dividends to the extent of the statutory limit for all the years during which they had paid less; but he should like to know whether this was ever done to any practical extent. The only other point he would call attention to was the rate of interest paid by local authorities, which Mr. Lees showed amounted to 4·39 per cent. including proportion of loan and interest. In many gas undertakings, money could be obtained at quite as low a rate as this, and for even less, as shown by the present value of gas companies' stock.

Mr. J. R. Smith (Padiham) said there could be no doubt about the value of the papers under discussion. It struck him that the varied circumstances attending local authorities in their management, prevented anything like uniformity in dealing with finance. In his own case, the Local Authority acquired the gas-works 25 years since, and the water-works at about the same time. But in 1882, it became necessary to get a new water supply, for they were on the borders of a water famine. The estimated outlay was £41,000; but when the works were completed, they were found to have cost £75,000. Mr. Carr told them he was protected in the Widnes Act by a clause which prohibited appropriation of profits, except to reductions in the price of gas. By way of showing the variety of views which Parliamentary Committees took, he might mention that in their own case they had a clause which made it possible for the profits from the gas-works to be appropriated to the payment of the interest on the water-works money borrowed. The view he took was that local authorities, when they acquired the gas interest and other properties which appertained to local government, ought to look at the question as a whole; and it might be very desirable to carry out the ideas enunciated by Mr. Carr and Mr. Lees. But in practical applications, difficulties arose. It was rather singular that a complaint should have come from Widnes, where the consumers were in such a happy position that they had gas at 1s. 8d. per 1000 cubic feet, and it was proposed to reduce the price to 1s. 6d. It seemed there was always most grumbling when there was least room for it. His experience taught him that, when there was a balance of profit ready to be appropriated, there was always a clamour as to how it should be dealt with. There was no doubt that gas-works, as a rule, were being managed well, both by local authorities and private companies. He had had experience of both; and he was not disposed to think hardly of management by local authorities. But, as already pointed out, one difficulty was the constant change in committees. No sooner were there one or two fresh men on, than they had to be instructed, and brought up to the standard already reached by the others. This had been his duty. These men were good, sensible men in their own particular sphere; but it was only natural to suppose that, when they were put to a duty to which they had not been accustomed, they would show lamentable ignorance. They were much indebted to electricity for giving an impetus to the consumption of gas, by creating a demand for a more intense light than formerly obtained, or which they were accustomed to give; so that, on this ground, they must give the electric light its due. It struck him, while the papers were being read, that, if he had come in as a stranger, it would have occurred to him that these papers were written by men interested very strongly in gas-works management. They all knew Mr. Carr, and what he had done at Widnes; and they were very proud of it. But they wished him to remember that all managers were not protected as he was by Act of Parliament.

Alderman Miles (Bolton), while fully admitting and agreeing with a good deal of what these two papers contained, was bound to say that there was a spirit pervading them somewhat akin to that of the Irishman, when he said: "Will anyone tread on the tail of my coat?" He had been a member of the Institute for thirty years, and still desired to be regarded as a former gas manager; though from what he had seen the last year or two, he rather thought he was sometimes looked upon more as a corporation man—as Chairman of the Gas Committee—than as a gas manager. Practically, he was born in a gas-works, and had remained in them for thirty years; and though circumstances occurred which severed his connection with the active management of gas-works, he should not wish to be regarded except as much the manager of a gas-works as any gentleman present, for his interest and love for the profession were as great as ever. Fortunately or unfortunately for him, immediately on severing his connection with the active management of a gas-works, he was elected on the Corporation of which he had been a member ever since. For some years he was Chairman of the Gas Committee; and speaking from a gas man's point of view, he thought both the authors had been rather too hard upon gas municipalization, and many of their remarks would not bear justification. At any rate, his experience led him to the belief that, if they were correct, Bolton was about one of the most model towns to be found in the country, for their remarks did not apply there. Mr. Lees said:

> A further disadvantage under which the consumers are placed by municipalization is the removal, to a very large extent, of all independent supervision with regard to the illuminating power and purity of the gas supplied. This is considered to be a matter of great importance when the works are under a company; and there can be no doubt that consumers are fully entitled to the protection provided by Parliament in this respect. But the fact cannot be ignored that, when a transfer takes place, the Act becomes practically obsolete in the majority of cases.

He demurred to this statement entirely. Then he went on to say:

> It has been suggested, in reference to the transfer of the London Companies to the County Council or to a new London Municipality, that such a proceeding would "at least help to place a few gas testers among the unemployed;" and that "that inquisitive instrument, the portable photometer, would be put away in a back yard somewhere, and forgotten."

He did not think that this was very judicious language to use, for he knew the testing of gas was not to be dealt with in such a way. The electric light was frequently referred to; and the spirit seemed to be that this light was not welcome. But if they brought their gas, as Mr. Carr was trying to do, to the low price of 1s. per 1000 cubic feet, they would not destroy the electric light; nor yet even if they brought the price to 6d. per 1000 cubic feet. They were bound to admit that electricity was applicable to many cases in which gas was not so suitable; and therefore they must remember that the electric light consumers did not always put the light in their premises merely for the purpose of advertising their wares to the disadvantage of some poorer gas consumer in a back street. The gas consumer would just as willingly advertise his wares by means of the incandescent or Denayrouze gas-burner. Was there any injustice in the application of the surplus profit to the relief of the district rate? He could not see that there was. To his mind, the gist of these papers was all on this point—Was it right to apply surplus profits to the relief of the district rate? He believed it was—providing it was done in a reasonable manner. But the whole thing hinged on that. If there was any grave abuse where this was done to the detriment of a consumer, that community was not an intelligent one; and the gas engineer who permitted it without raising his voice against it with his committee, was not what he ought to be. It all depended on the point whether the two matters—the price of gas and the amount applied to the relief of the rates—were adjusted in an equitable manner. He claimed that in Bolton this was done. The Corporation had had the gas-works for 25 years; and by the Act of Parliament under which they acquired them, they were bound to provide for certain funds. When these were fully met out of profits, the balance (if any) must be devoted to the relief of the district rate. Therefore, they were doing no injustice to the consumer. It was the duty of the manager to get as many of the ratepayers as possible to be consumers; and this had been one of their strong points at Bolton. There were 33,000 gas consumers; and working this out at an average of five people in each house, he made out that they had about 93 per cent. of

the ratepayers as consumers. If this was the case, where was the injustice? He was bound to admit that there was a tendency in the minds of gentlemen forming gas committees, to apply as large sums as they could to the relief of the rates. But this tendency had been enhanced considerably in the history of many corporations by the fact that they had large communities outside the borough, who had no responsibility whatever with regard to the maintenance of the works, or to anything which might occur in connection with them; and consequently the borough consumers were not averse to keeping up the price to a reasonable figure, in order that these people should not have so much benefit as they otherwise would have. With regard to electricity, something was said in the papers as to whether electric undertakings of the corporation or corporations were ever subsidized at the expense of the gas department. In Bolton they had an electric undertaking connected with the Gas Department, under the same Committee; and they made losses at the commencement of the business. Some three years ago, when a paper was read on the subject, he said he would be no party to subsidizing electric lighting losses out of the Gas Department. He was afraid he had been guilty, more or less, of having to do this against his will. But the Electric Lighting Department would have to pay its way in future. They gave over the profits from the Gas Department to relieve the district rate; and any deficiency in the Gas Department, would have to be made up from this rate. He was glad to hear it stated that more than one corporation was in the position of really assisting the gas-works out of the rates. The district rate had had to help them out of a difficulty in the case of the electric lighting works; but electricity was an industry only just commencing. If they started a gas-works, they did not expect to make any profit for the first two or three years; and it was the same with electric lighting. They had made a loss; and though they did give with one hand some of the profits of the Gas Department to the relief of the rates, with the other they took back something from the rates to subsidize the electric lighting works. But they had now about got to the end of this; and next year they would make a handsome profit out of the electric light. Then the profits, to a reasonable degree, would have to go to the relief of the district rate. The electric light works were being put on the same principle as the gas-works. If anything did occur in connection with municipal gas-works which engineers objected to, it was their duty to advise their committees. Here, again, Bolton stepped in as a model town. All they wanted was a good engineer, and a reasonably-minded Chairman of Committees, and the thing worked as smoothly as possible. If gentlemen who acted as engineers would cultivate an amicable spirit, he believed there would not be much difficulty. He did not think the chairman should take the position of the engineer. But his duty was to consult with him, and know what he wished should be done. If they worked together, success would be assured.

Mr. J. Stelfox (Belfast) said he agreed with everything which Mr. Carr had said; but at the same time he was rather inclined to agree with Mr. Hunt. In discussing the matter there, they were something like an association of land and estate agents who objected to the way in which their employers spent their income, and had a meeting among themselves to say so. If they brought any pressure to bear on their employers, well and good; but this was not likely to be the case, unless someone like Mr. Alderman Miles went and repeated what they were saying. It was a monstrous thing to load the gas industry with charges for this, that, and the other thing. He was inclined to think that, as long as money came easily, it went easily. Many people managed to get on with £100 a year, who could spend £5000 a year if they had it. Sometimes expenditure of this sort, when the means came unexpectedly, was not the most profitable. He remembered hearing of a case where the Secretary of a Missionary Society received a note one morning saying a worthy old lady had died, and left a donation of £100. The Secretary said it was quite providential, for they wanted a new set of office furniture very badly. He was afraid that, so long as money was provided in this way, something equivalent to the need for a new set of furniture would often be the result. After all, the real thing was, What did the people themselves want? If the people (say) in Belfast chose to spend their money in this manner, it was not his business to step in and forbid them doing so. He did not think they required to ask his advice; and he did not thrust his advice upon them. Consequently he was generally consulted. As long as the system was tolerated, it would be carried on; and the only appeal was to the people, who were in the end the masters. It arose to a great extent from the fact that, though they might not theoretically approve of indirect taxation, they put up with it. Nearly everybody grumbled when the income-tax papers were delivered; but when they took a glass of whisky or a glass of beer, they never thought how much they were paying out in the form of taxes—probably quite as much as the amount of the income-tax in the course of the year. So it was with the surplus from the gas-works. People would not stand the raising of the rates; but they would pay an extra price for gas which would be equivalent to a 2d. rate, while they would protest against the addition of ½d. if levied direct. He saw no reason why the community should supply gas any more than other things—such as washing or clothes. As Mr. Lees had pointed out, the difficulty of getting money cheaply, which really did operate a few years ago, did not exist to anything like the same extent now. As regards the price of gas, he agreed with Mr. Carr that they should make it as low as possible. But he did not think they should go to the very cost price; for in this case it might in a favourable year be reduced very low, and if anything happened another year, the price would have to be raised, which would be very much resented. He knew an instance where everything went on pleasantly as long as the price was being reduced; but a time came when it was necessary to raise it, and then there was a perfect hubbub. The price was very low at Widnes; and in their own town they could have sold gas last year at 1s. 7d. per 1000 cubic feet, and paid their way. But it was not considered advisable to do so. In their large district, they had no differential rates. All the consumers throughout the area of supply were getting their gas at the same price, and with the same discounts. He thought in Mr. Carr's case there was a differential rate; and it would be interesting to know the average price, including the portions in which a higher price than the minimum was paid.

Mr. William Carr (Stalybridge) said, with reference to the taxing of gas-works profits, there was no doubt about the right of a corporation in many instances to do so, as was pointed out by Mr. Alderman Miles. It was not a mere question of right, but of good sound commercial policy. The figures given by Mr. Lees were very valuable; and they were much indebted to him for them. The great point was that of management. It was not all gas engineers who were in the position of the Engineer at Bolton, who had a gas engineer for a Chairman. Unfortunately, as had already been stated, one got repeated changes of committee; and there was altogether absent that self-interest which actuated the directors of a gas company. These members of committee often came in with interests quite contrary to those of the gas department. It might not be general, but it often happened; and many times their connection with the committee resulted in certain loss to the department. Therefore, it was wise for engineers to influence their employers as far as possible to what they considered the best policy to be pursued in the proper administration of the gas department; and he considered these papers to be very well timed. One ray of hope he found in the Manchester papers—that the Manchester Electric Lighting Committee had actually handed over £10,000 last year to the relief of the rates. This was in the evidence given by Mr. Alderman Higginbottom before the Inspector sent down by the Local Government Board to hold an inquiry whether they should have power to borrow another £130,000 for extensions. If this were done, it would make £480,000 of capital employed for this purpose; and as near as he could ascertain, they were doing as much lighting as they could have done with £100,000 of capital expended on gas-works. However, if they were compensating the consumers or the ratepayers, or somebody, by handing over £10,000 for the relief of the rates, there was a little ray of hope for gas suppliers at any rate. If they only began to tax the electric light (which was their chief rival) the same as gas, they would not have so much to grumble about.

Mr. C. A. Craven (Dewsbury) thought these papers were both very valuable; and the subject had been treated with much moderation. He had had experience both in serving a corporation and a private company; and he had also

worked for a number of years abroad, without a corporation or committee of any kind. He found that there was a sort of undefined dread on the part of some people who were managing private gas-works, that they would come under the hands of the corporation; but he could only say, from his own experience, that he did not think they had much to fear. He had a committee with whom he had got on extremely comfortably; and, in fact, he could say that he had never had a bad committee. He held that a committee had a perfect right, within reasonable bounds, to devote a portion of the realized profits for the benefit of the ratepayers, who had the responsibility of the capital charges. If one took the number of people who were ratepayers, in some places half were consumers. In other towns about four-fifths were consumers; and taking the 20 per cent. who were not, they were nevertheless responsible for their *pro ratâ* share of the money which had been spent on the works. If they happened to be unfortunate, they would certainly have to go on the rates for losses or damages. They would not go to the gas consumers to pay any damages which might accrue from an accident, but to the ratepayers; and they had a claim for a reasonable amount of relief as proprietors. They occupied virtually the place of shareholders of a company. Having paid the money for the works, they stood in the same position, and had a right to reasonable advantages. This was the view he had always taken; and he still adhered to it.

Mr. R. Merrell (Mossley) said in his own case, they were under what one might term modern legislation; the Municipality having purchased the works some twelve years ago. So far as the consumers were concerned, it had been advantageous to them, as the charge for gas had been about 11d. per 1000 cubic feet less than the twelve years previous. With regard to the division of profits, they were tied down by Parliament, so that, unless they sold the gas below the standard price, they could not participate in the profits at all. If they made a profit when gas was sold below the standard price, they were allowed to take one-third; the other two-thirds had to go to reducing the price. The gas used in the public lamps had to be paid for at the same rates as were charged to any other consumers. In this respect, he quite agreed with Mr. Carr. By their Act, if they were to participate in the profits to relieve the rates, they could only do so by reducing the charge for gas to the lowest possible figure.

Mr. A. Dougall (Tunbridge Wells) said there was one point in Mr. Carr's paper he should like to emphasize. He said the monopoly which gas had so long enjoyed was fast disappearing, and that they had a stern and real competitor in the electric light; and that for this reason gas should in future go free from taxation. But in another part of the paper, he said that where a town was supplied with gas by a company, and the corporation took up electric lighting, the latter were not as a rule overburdened with success; and the same might be said of electric light companies who had opposed and competed with gas companies. He came from a town which was supplied with gas by a Company, and with electric light by the Corporation. The Electric Light Committee had just issued their first balance-sheet, which showed a profit of £1700—£900 of which was to be devoted to the relief of the rates, and the balance to be carried forward. While he did not believe the accounts would bear the light of criticism, still, assuming them to be correct, it was apparent that, whether it was gas or electricity which was being supplied by a corporation, the principle of applying any profits therefrom would be the same.

Mr. Lees, in reply, said Mr. Shoubridge had expressed a wish that these papers could have been read before members of municipal corporations. It would have given equal pleasure to himself to have read his before such an assembly; but they had not the opportunity. It was to be hoped that members of the Institute would at any rate carry back to their gas committees such information as they approved in these papers. He believed the question of municipalization would almost cease to be heard of if consumers understood the question; and this was his object in writing the paper. As a rule, gas consumers comprised the greater proportion of ratepayers; and if they understood the position in which they would be placed by the transfer of gas undertakings to corporations, he felt sure their vote, at any rate, would not be in favour of the transfer. Mr. Tobey pointed out that ¾ per cent. on the total capital employed by the local authorities in gas-works was about equal to £187,000. But he omitted what he might clearly have stated, and which was shown in the paper—that in addition to providing the interest on the loans, the gas consumers had to provide a sinking fund which went to pay off the capital; and this came to 4·39 per cent., according to the parliamentary returns. He was rather surprised that Mr. Tobey did not see the analogy with regard to a comparison between the municipalization of gas undertakings and the nationalization of railways, or the supply of food or clothing. It was not a question of giving a monopoly to an individual in the transfer of these industries, but to the communities, and there could be no more injustice in dispensing food and clothing than there could be in selling gas. He was obliged to Mr. Griffith for the manner in which he had supported the arguments adduced in the paper. Mr. Smith referred to a variety of circumstances which prevented uniformity in administration, which was no doubt the case; but to get something like uniformity in his conclusions, he had spread his statistics over a very wide area. His intention had been to state the case as he thought it ought to be stated on behalf of the companies, which was very seldom heard, and especially on behalf of the consumers; for, after all, it was more a consumer's question than one for directors or managers. Mr. Smith also said it might be desirable that the views stated should be carried out; but it was not always possible. It was quite practicable to act upon the views he enunciated, because it meant simply leaving things as they were so far as gas-works which were well managed were concerned. He quite admitted there were works which would be better administered by another body of men than those in whose charge they were placed; but they were the exception. He was sorry Mr. Alderman Miles did not happen to be present at this juncture, as he wished to refer to one or two things he had said. But he must certainly disclaim any idea of wishing anyone "to tread on the tail of his coat," if this reference had a personal meaning. Mr. Alderman Miles said many of his remarks would not bear justification. This was easily said. But he had stated these things for discussion; and if they were not justifiable, it remained for him who had said so to prove that they were not correct. He still stood to his words. Special reference had been made to the statement that individual supervision was largely removed. He still stood by that. Where an inspector was appointed under a local authority, very frequently he was the servant of that local authority; and they knew that in some prominent corporations in the north, at any rate, sulphur compounds had been sent out which would have led, in case of a company, to an action being brought against them. Mr. Alderman Miles contended that a tradesman did not put in electric light for advertising purposes. He (Mr. Lees) maintained that this was one of the purposes for which it was used. But it did not matter whether it was so or not, the gas consumer in the case cited had to help to pay for his neighbour's electric light. The gist of the question in Mr. Carr's paper might be as suggested, the appropriation of profits; but his (Mr. Lees') paper contained another point equally strong. He had shown that, apart from the appropriation of profits, the consumer must pay more money for his gas in the event of a corporation acquiring the gas-works now, than he would if the works remained in the hands of a company. He thought he had shown this clearly; and his figures had not been disputed. He had taken them carefully from a wide area, in order to get a fair average. Then they were told that Bolton was doing no injustice to the consumer. This was a question for the Bolton consumers to decide. It cost, to pay interest on loans and sinking fund, rather over 6½d. per 1000 cubic feet; and 7½d. per 1000 cubic feet, within a fraction, was transferred last year to the relief of the rates. Therefore the Bolton consumers were providing 14d. per 1000 cubic feet; whereas under a company they ought not to have provided more than about 8d. or 10d. If this were clearly understood by consumers in towns where this sort of thing was done, they would, he thought, rebel against it. At any rate, there could be no claim to the effect that gas consumers were as well off under a corporation as under a company. It was a very cogent remark of Mr. Stelfox—that where money came easily, it went easily—which he (Mr. Lees) had brought out by a quotation from Sir Henry Fowler. As he said, they were in the hands of the ratepayers. The consumers wanted

educating; and when they understood the matter sufficiently, he believed they would declare a policy very different to that now generally practised. Mr. William Carr said the great question was that of management. He (Mr. Lees) admitted that, without good management, good results could not be obtained under any circumstances; but he had tried to show that in the case of well-managed works, better results could be achieved under a company than under a corporation.

Mr. Isaac Carr, in reply, said the first point he need refer to was that raised by Mr. Tobey, who, speaking of the support that gas-works belonging to local authorities had received from the rates, instanced one or two isolated cases. He knew from his own experience of one or two instances where local authorities had to draw on the rates of the borough for very large sums of money to meet deficiencies in the gas account; but, as he had stated, this was for some sudden and perhaps temporary emergency. Then it must be clearly understood that all these moneys which were being paid in support of the gas department at present would be put to the debit of the gas account; and there was not a doubt but that they would be repaid hereafter, as they had been in cases which had come within his own knowledge. Mr. Smith said he thought most of the grumbling took place where there was least room for it; and that the people of Widnes, having gas so cheap, ought to be very well satisfied with what they were getting. The policy he advocated was to sell gas at cost price; and he might tell Mr. Smith that, the cost price of gas at Widnes being 1s. 2½d., after paying every penny of indebtedness, he considered to charge 6d. per 1000 cubic feet more was selling it at a deal above cost price. Mr. Alderman Miles seemed to think that the two papers were submitted with a view of inviting severe criticism, with a dare-to-tread-on-the-tail-of-my-coat tone throughout. But he (Mr. Carr) could assure them that, in preparing his paper, he considered it a matter of great urgency. In many towns, there was not only some one treading on the tails of their coats, but giving a pretty good rent to the cloth as well; and had it not been for this, he should not have brought the subject forward. He had tried to say, as forcibly as he could, that it behoved them to look after their own interests, and to see that the industry they represented was not rendered obsolete until everything about it was utilized to the fullest possible extent. Mr. Alderman Miles had stated that the electric light would remain; and he agreed that, not only would it remain, but it was highly desirable in the interests of the general public that it should do so. They could not consider themselves in such a matter—they were only individuals looking after their own particular business. Mr. Alderman Miles said he thought it was perfectly right that the ratepayers should have relief from the gas-works, for which they were financially responsible. He (Mr. Carr) disagreed with him entirely on this point. He believed local authorities would get far more credit by selling cheap gas than by charging a high price, and appropriating the surplus for the relief of the rates. He was not at all sure that this policy conduced to economy of municipal management, but was rather inclined to think the contrary. So long as a municipal authority knew that they had a good deep pocket to draw upon in order to cover up any mismanagement in municipal matters, it made them less careful than they would be if they had to raise the money they required from the ratepayers. This view was borne out by the remarks of Mr. Stelfox, who did not think it was at all worth his while to insinuate his own opinion on the matter of the appropriation of gas profits. But he could not quite agree in that conclusion; for he thought that, if a gas engineer or manager believed the policy which was being pursued by his committee was to the detriment of the department for the management of which he was responsible, it was his duty to at least give expression to his opinions. He could not, of course, compel his committee to take notice of them; and perhaps in some cases they would tell him to mind his own business. But if among the members of the Institute this subject were taken to heart, and their opinions were given voice to, doubtless in many places they would be heeded to a great extent, and make a deep impression. With regard to differential prices, they had a differential rate of from 1s. 6d. to 3s. per 1000 cubic feet. They supplied a village some seven miles away at 3s. per 1000 cubic feet; and the total revenue from this village might amount to £35 a year. The average selling price at the present time was, as near as he could tell, 1s. 7½d. per 1000 cubic feet, including the borough and the outside districts at the higher rates. He quite agreed with Mr. Craven that the corporations had a right to appropriate the gas profits; but the object of his paper was to question the policy of this appropriation. Mr. Craven said the liability was with the ratepayers. But he would remind him of one or two passages in the paper, where he tried to point out that, if his works fell on bad days, and they had to commence increasing the price, they must charge the maximum rate before they could even come on the ordinary ratepayers for a penny; and the probability was that the maximum rate was double the present selling price. So that before the period could elapse when any capital liability could come on the ratepayers, the generations who had shared the profits and had the benefit of all this money—if it was a benefit—would have passed away; and the money would have to come out of the pockets of people who had practically never received a penny. He was pleased to hear the remarks of Mr. Merrell, who represented one of the works he instanced in his paper, where Parliament had restricted the power of the Corporation in appropriating profits. His testimony was very timely in speaking to the excellent working of this legislation. Mr. Dougall instanced the case of the Tunbridge Wells authorities appropriating profits from the electric lighting in relief of the rates. He had nothing to say on this point, except that it was as unfair to the electric light consumers as to the gas consumers at the present time. But this was a matter for electricians to look after; and no doubt in due course they would do so. He had expected to be asked some questions on the Widnes undertaking with regard to its capital account; and he had brought one or two figures with him. In 1884, the capital employed per 1000 cubic feet of gas produced was 17s. 10d.; at present, it was 7s. 9d. Per ton of coal, it worked out in 1884 to £8 6s. 8d.; and now to £3 13s. 2d. Standing charges stood in 1884 at 1s. 2d. per 1000 cubic feet; these were now reduced to 5½d. Per ton of coal in 1884, they were 10s. 4d.; and now, 4s. 4d. He mentioned these things to show that their position as regards capital was very excellent; but their capital was not nearly so low as that of many authorities he might instance. He was very pleased that these papers had been so well received. The advisability of the Institute discussing the subject had at the outset been questioned by some of his friends; but he thought, from the favourable criticisms the papers had received, it was quite certain their efforts in this matter would not have been altogether thrown away.

GAS DISTRIBUTION IN RELATION TO MODERN MUNICIPAL DEVELOPMENT.

By Thomas Canning, of Newport (Mon.).

A characteristic feature of civilization in the nineteenth century has been the development of cities and towns. In Great Britain, this development of urban concentration has been more marked than in any other country. Sir J. W. Bazalgette, in his address in 1884 to the Institution of Civil Engineers, pointed out that London is "without a rival as regards its size and population, not only in the present, but as far as we know in the past history of the world." Its present population is equal to the aggregate population of the three great cities of the ancient world—Rome, Carthage, and Babylon, with the population of the modern city of New York superadded. In ten years, it has advanced about 400,000—a number equivalent to the entire population of Leeds. The population of thirty-five of the largest towns of Great Britain and Ireland outside the Metropolis, was in the year 1886 6,386,385, in 1896 7,484,939; being an increase of 1,098,554, or equal to the entire population of Berlin. Other places are rapidly rising up that will, before another decade has passed, reach the 100,000 limit or so, necessary to bring them under the category of a large town. It is noticeable, however, that the Metropolis has now a lower rate of increase than the provincial cities and towns. In ten years London has only increased 10 per cent., while in provincial centres the increase has been at the rate of 17 per cent.

Government—municipal government—was early found necessary to meet the requirements of the ever-growing urban populations; and wherever such government has become established, vast signs of change at once appeared.

Boundaries were enlarged, new streets were opened, old streets rebuilt (their lines of frontage often altered to make carriageways and footways wider); while, again, these routes for vehicular and foot passenger traffic have been paved by new methods, and with new materials—the chief novelties consisting of wood, asphalte, brick, granite sets, and cement concrete paving. The drainage, the water supply, the lighting, and the locomotion in town thoroughfares have all undergone a great revolution within the past twenty-five years, and surprisingly so within the last decade. Electricity, too, has come upon the scene, both for the supply of light and of motive power; and it is in the future likely to be employed considerably in tramway traction.

Electric lighting is the spoiled child of municipal benevolence. No other industry owes so much to municipal fostering; but there can be no right to credit of enterprise in such undertakings, for no risk is involved. It would, however, be an error to suppose that electric lighting owes all its progress to municipal aid. In the provincial cities and towns, electric light supply has been the result mainly of the efforts of the municipalities; but the capital of private electric light undertakings, especially in London, is up to the present very considerably beyond that of municipal concerns. Another error is to suppose that, in bringing the excellent Welsbach light into competition with the incandescent electric lamp, the gas manager may rest contented. The Welsbach light has been successful, and deservedly so; but it does not answer all the requirements of gas managers. The field is still open for the introduction of an improved burner, which need not necessarily be of the incandescent type. The gas industry has fortunately suffered little from the adoption of its favoured rival. But this should be a reason for those engaged in it not to relax, but to redouble their energy and vigilance.

In work affecting gas affairs but little—such as technical education, providing parks, libraries, museums, fire brigade stations, and hospitals—municipalities have also been occupied, creating in all developments as rapid as unexpected, and largely influencing the question of gas distribution. The author considered the foregoing remarks would not be inopportune as serving as an introduction to a fuller treatment of what cannot but be regarded as a most important subject.

Extension of Boundaries.—Two processes go on simultaneously in growing towns—an extension at the limits and concentration at the centre—the causes of which it is not necessary here to explain. Mains of larger diameter are required, not only as regards actual supply of extended area, but proportionately as regards the districts, than were formerly needed. Thirty years ago, gas was taken from the main by a small number of consumers for one purpose only—viz., lighting. At the present time, the mains are drawn upon by a large number, and at certain hours simultaneously, for at least four purposes. Mains, too, are reached, repaired, renewed or extended, now, with ever-increasing difficulty, risk, and expenditure. Hence no subject requires more attention than the correct proportioning of mains to the supply. The maximum hour's consumption must determine the diameter of the district trunk main, whether a service main or an independent main.

In the diagram exhibited (fig. 1), the author shows how, in a progressive gas undertaking, the maximum day's consumption has increased since 1868, also the proportion borne to this by the minimum day's consumption; that of the maximum hour; and the consumption from 11.0 a.m. to 3.0 p.m. The proportions are accurate, and actually represent the advance made and the rate of progress. The maximum consumption in 24 hours has multiplied 3·6 times in 28 years; the maximum hour's consumption has increased 3·5 times; the minimum day's consumption has advanced 3·3 times. But on the minimum day, the consumption between 11 a.m. and 3 p.m. has increased 8·75 times; and on the maximum day, the consumption for these four hours has increased 7·33 times. It is satisfactory to note that the middle-day consumption of gas in summer exhibits the largest increase of all. In 1868, the maximum hour was 114-100ths of the maximum day's consumption; but in 1896 it was 106-100ths. It is a good sign of steady advance when, in a progressive concern, the maximum hour's consumption recedes in comparison with that of the maximum day. The maximum hour's consumption, then, is about one-tenth that of the maximum day; but the author has reason to believe that it varies in different centres.

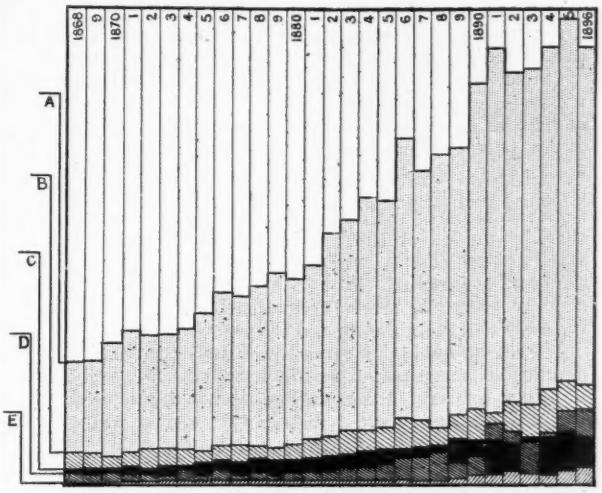


FIG. 1.

The diagram shows that the increase in consumption during the 29 years—1868 to 1896—had been as follows:—

A—Maximum day's consumption	. . . .	3·60 times
B—Minimum day's "	. . . .	3·30 "
C—Maximum hour's "	. . . .	7·33 "
D—Maximum day's "	(11 to 3) .	3·50 "
E—Minimum day's "	" .	8·75 "

No general conclusion can be based on a single case—or example, in a manufacturing city like Oldham the maximum hour's consumption must be a large proportion of that of the maximum day. In deciding, then, the diameter of a trunk main, it is necessary first of all to estimate what the maximum day's consumption may be, say, twenty years later on. Twenty years, while too long a period for anticipation in regard to provision for manufacture and storage, is not, the author believes, too long with reference to distribution. It may perhaps be considered too short a time, as many mains have been known to live and thrive for fifty years. But in large centres of population, opportunities of duplication may occur; and considering all circumstances, twenty years may be accepted as the period to be taken into calculation for arriving at the diameter of the trunk main. Dividing the prospected maximum day's demand at the end of twenty years by the number of maximum hours' proportion, and calculating the diameter of the main that will supply this at the required distance under the necessary pressure, will give the result desired.

With reference to the replacing of one main by another of larger diameter, a fallacy exists in some quarters that the supplying capacities of the mains vary as the squares of their diameters. As a matter of fact, the capacity variation is as the square roots of the fifth powers of the diameter, expressed by the formula:—

$$\text{Relative discharging capacity of pipes} = \sqrt{d^5};$$

where d = the diameter in feet or decimal parts of a foot. This formula is founded upon the principle common to mathematics and physics—to theory and to experience—that the volume of fluid delivered by a pipe is equal to the product of the sectional area of the pipe multiplied by the mean velocity of flow. In its results, the formula is in close correspondence with the figures given in Barlow's and Newbigging's tables in "King's Treatise on Coal Gas" (calculated from Pole's formula), p. 382.

As an example of the application of the above formula, a 12-inch main under 2-inches pressure, delivers 33,600 cubic feet of gas per hour at the end of 2000 yards. It is required to find what a 14-inch main, under the same conditions, will deliver. The square roots of the fifth powers of the diameters (12 and 14) are as 1 : 1·47. $33{,}600 \times 1{\cdot}47 = 49{,}392$ cubic feet, the discharging capacity required. The figure given in Barlow's tables for corresponding conditions is 49,400 cubic feet. So, in like manner, a 12-inch main compared with an 18-inch one is as 1 : 2·756; and again it will be found that the result corresponds

with the tables. By the old rule, a 24-inch main was considered equal to four 12-inch ones. But it is really equal to 5·657 12-inch mains. It may be questioned, then, if there is any need for the formula. It brings out prominently the fact that a 24-inch main can supply 32 6-inch pipes, and not 16 only, as too frequently stated. It is a proportioning formula, and so therefore has its own use.

Objections may be raised to the use of formulæ; the results of experience being preferred. But the author is endeavouring to indicate that experience is daily changing under new environment, one result of which is that the diameter of the average main in most progressive gas undertakings will have to be increased in future to a degree not contemplated within former experience. He has shown that, by means of the maximum hour's consumption, a starting base is at once obtained; and, knowing the quantity to be supplied through a certain distance under a certain pressure, much assistance can then be derived from reliable formulæ, tested by practice.

It will be generally agreed that the manufacture of gas should be concentrated as much as possible, and that to multiply manufacturing stations is not economical. It is found necessary to erect distributing stations in growing centres; but this is not always desirable.

Street Paving.—Great changes have been made in the street pavings of large towns. The use of any kind of street paving requiring a cement concrete bed has the effect of rendering the detection of gas escapes very difficult. When the carriageway pavement is of wood or asphalte, and that of the footways of granolithic cement, this detection becomes impossible until the gas has made its way into the cellars of the frontagers, which may be too late. The author's practice is to examine, and renew or repair if required, all mains and services at the time the road is stripped for first laying such pavements. For detecting leaks he has fitted into wood pavements a small shaft with a strong cast-iron cover, leading from the surface down to the main, as shown in the diagram fig. 2. These are

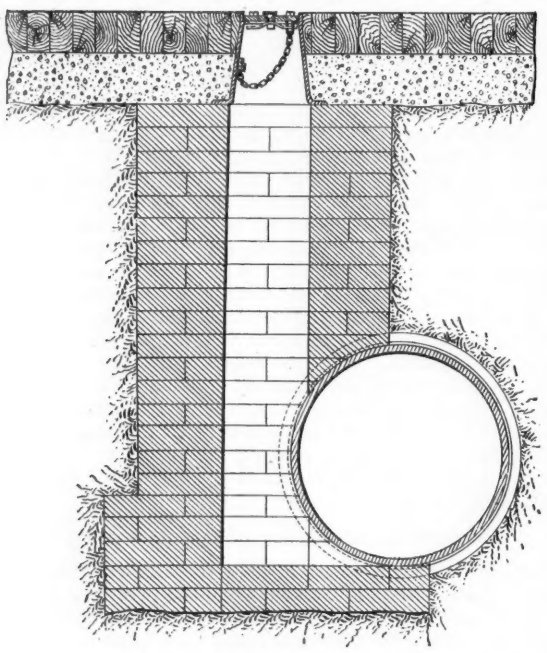


FIG. 2.

fixed at reasonable intervals apart; and an inspector opens and examines them from time to time. They not only indicate an escape, but enable its position to be pretty closely determined. They also help to dissipate the rush of gas, if any. Beneath the granolithic pavement are placed, in the proper situations, 3-inch glazed earthenware pipes, through which the house-services pass. Their advantages are obvious. Glazed earthenware is preferred to cast iron, for the lengths are more suitable to the irregular widths of pavement, and the difficulties of rust are avoided. It is well to follow a similar plan for services under tram-lines, as it is always easy to drive a boring beneath them. In this case, however, the outer pipe should be metal.

It has been suggested that double lines of service mains should be laid, one on either side of the street—so avoiding opening all across a street for long services. In view of what has already been said as to proportioning mains, such a plan can only be regarded advisable in very wide and very busy thoroughfares. Mains under pavements are objectionable. As to subways, they are too costly to become general. In the principal thoroughfares of very large cities, numerous subterranean streets for pipes and heavy traffic, with communication to basements, if properly ventilated, would have great advantages.

The introduction of electric lighting has added a fresh cause of expense, and some anxiety, to the sellers of gas. The law to some extent protects the gas distributor; but there are still cases of hardship requiring some redress. Gas is reported in a transformer box; but the leak may be far away from the box, and the gas may have penetrated to the box from a remote point through a defective electric culvert. The searching for the leak may be long and costly; and there are no means within the author's knowledge of locating the small defects in electric culverts. It is only too true that a defective culvert is very bad for the electrical distributor; and as electricians and gas men are equally interested, the difficulty ought to be soon overcome.

Increased traffic producing greater vibration, is a cause of considerable disturbance to gas-mains. The weight of traffic passing over each yard in width of busy thoroughfares, varies per diem from 250 tons in less busy streets, to 1400 tons in the busiest; and this weight will eventually tell upon pipes beneath the surface where the subsoil is shaky. In the case of the steam-roller, it is the vibration caused by its hammer-like motion over pipes laid upon infirm sub-strata that causes their breakage.

The jerry-builder—an obnoxious parasite on municipal development—has often been, and will continue to be, a very disturbing element as regards the soundness of pipes. By a section of the Public Health Act, owners and occupiers have a right to connect their house-drains to the street sewer. The jerry-builder most frequently does this; and it means destruction to any gas-pipe laid previous to his operations, as he neither fills nor rams the excavations adequately. He is supposed to do his work under inspection; but inspection can only be intermittent. The result is therefore most unsatisfactory.

Electrolytic Action.—To substitute electric energy for horse traction as the motive power for tramcars, is an idea that possesses some municipalities, especially those with an electricity supply works. Gas is certainly more easily applicable, equally efficient, and quite as economical. Many suppose that electricity from an electric light station applied to traction would reduce the cost of the current. Only to a slight extent would this be the case, for one set of generators could not energize trams, start them, and stop them, and keep up at the same time steady lights. But this is not the point. Rightly or wrongly, the idea of electric traction is in the air; and what has to be examined is: Are the return currents likely to injure gas-pipes? If so, to what extent; and is this injury preventible, and how?

The motive power to the trams is supplied from the power-house, situated generally equidistant from the termini. The system at Bristol is a fairly typical one. In this installation, there are three slow-speed continuous-current dynamos, capable of yielding an output of 200 ampères at 550 volts, when running at 650 revolutions per minute. Two complete trolley wires run from end to end of the line, for supplying current to cars running in opposite directions. The return current passes through the rails, which are connected electrically at the joints by what is called the "Chicago" rail bond—that is, two copper rods 0·4 inch in diameter, each flattened out at the ends, and connected by steel pins with the rails.

To briefly summarize a description of the electrolytic process, it may be stated to consist of the decomposition of liquids by means of electric currents; the liquid so decomposed being called the electrolyte. Electrolysis is thus chemical change produced by electric current. In the ordinary voltaic cell, the converse occurs, and the effect is chemico-electric, for an electric current is produced by chemical action. The earth impregnated with moisture, often containing acids, underlying the surfaces of streets, is capable of becoming an electrolyte. When an electric current passes in common water from one metal plate to

another, the fluid is decomposed; oxygen going to the positive plate, and hydrogen to the negative plate. The immersed surfaces of these metals are known as electrodes or poles; the positive pole being called the anode, and the negative pole the kathode. If the metal of the anode is oxidizable, it will corrode from the liberation of oxygen and acids there; while the negative plate at least suffers no injury. If an electric current finds it easier to take part of its way back to the power-house through an underground pipe, or pass from one pipe to another, if the pipe is positive to the rail, then at whatever place or places the current leaves the pipe to go to another, or back to the rail, at such place or places the pipe will be eaten away, and in time be utterly destroyed. Salts, acids, and escaping gas increase this action; and salts—especially chloride of sodium and sulphates of various alkaline bases—are very abundant in seaport towns, and, with the exception of the former, equally abundant in those inland.

Naturally, on account of the extensive introduction of electric street railways in America, more experience of this electro-chemical corrosion of pipes has been obtained there than in England; and in connection with this part of the paper, the author has to record his indebtedness to Mr. W. R. Addicks, of Boston, to the "American Gaslight Journal," to the report of the Committee on Electrolysis on the Western Gas Association,* and to the researches of Mr. Harold P. Brown, Electrical Expert, of Edison Building, New York. In the earlier electric tramways in America, no special provision was made for conducting the return current to the power-house. It was an axiom, but a false one, that the earth is a conductor, of which practically the resistance is zero and the capacity infinite. When later on it became apparent that this was an error, bond-wires were introduced into the rail-joints, much as above described, so as to make the rails the vehicle for the return current. But all this took some time. It was a long while before gas managers found out the damage, and naturally longer still before tramway managers were brought to acknowledge it. It is but very recently, indeed, that the effect of electrolytic action on pipes has been realized to any extent.

In a paper published on Feb. 18, 1895, Mr. Harold P. Brown says: "The recent rapid growth of electric railways through the streets of our cities, has produced conditions whose seriousness is not yet fully realized. Within the past few months, however, some of the most alert railway managers have realized that they are throwing away hundreds of horse power every day, in the work of injuring water, gas, and subway investments; and that some day they will be called upon to make good this damage." This may be so in America, it will be said; but in England the Board of Trade does not permit this loss. The Board directs that the difference of potential between the terminals of the uninsulated return shall be recorded. This difference is allowed to be as high as 10 volts. There is nothing to show by what route the return current comes, whether wholly by the rails, or partly by the rails and partly by the pipes. The record, to be useful for this purpose, should be supplemented from time to time by giving the difference of potential between the trolley and the rail, the trolley and some pipe or pipes likely to be affected, and between the rail and the pipes. The electric energy required to decompose any compound is only about the equivalent of the quantity of heat evolved by its constituents when uniting. Taking water, one gramme of hydrogen, or eight of oxygen, in burning to nine grammes of water evolve 34,500 centigramme calories. A volt corresponds to about 22,900 calories. Hence $\frac{34,500}{22,900} = 1{\cdot}50$ volts, the voltage of the electro-motive force required for water electrolysis—the most common. This would be reduced by the presence of acids; and looking at this small voltage, it is evidently most desirable that the tests indicated should be made.

In their report on electrolysis presented to the Western Gas Association, the Committee state, after reviewing schemes many of which are more complete than any thought of yet in England for preventing electrolysis: "As deterrents or diminishers, many of them assist; but not one fulfils the requirements of complete protection, nor can any system do so which uses the rails to any appreciable degree as conductors. . . . . The pipes will be called upon to bear a portion of the current under the most favourable circumstances, and in so doing will be injured; for it has been shown by experiment under conditions identical with those existing in practice, that electrolytic action may occur within differences of potential of 0·5 volt."

No more perfect system of return conduction is applied here, or proposed to be applied, than in America; yet Mr. Harold P. Brown says: "Assuming that bond-wires [rail bonds] are perfect, and the feeder wires ample, it is, of course, true that the current flowing on the pipes would be reduced; yet they would still carry a considerable proportion, and still suffer corrosion at the points where the current left them." The truth of this must be clear, when the large cross-sectional area of metal in the pipe network of any town, and the laws of conductivity, are taken into account. As a fact, the pipes are, in cases of poor bonding, the best conductors. It cannot either be argued for a moment, that the concrete road bed is an insulator.

It may be thought that water-mains will protect gas-mains; and that, being usually larger in area and filled with water, they will carry off the current. This is true to a certain extent; but their superior conductivity is of no avail to save gas-pipes. The current will always take the shorter route, and will be now in a gas-main, now in a water-main; and the more pipes there are in a street, the more will be the electrolytic injury done by the current leaving one to pass to another. If water-pipes have cemented, half turned and bored joints, and those of the gas-pipes are turned and bored, or lead only, the gas-pipes will be the better conductors.

There is no need to recapitulate the accounts of disasters to pipes throughout the United States, in which destruction was wrought in periods varying from five months to five years. When the cause was discovered, various remedies were proposed. The earliest plan seems to have been the coating of the pipes with non-conducting paint. Besides being impracticable, as regards a whole district, the current where it was tried entered at weak places and left at any point, destroying the pipe where it passed off. Pipes were laid in cement-jointed drain-pipes; but this also failed. At Los Angeles, the water-pipes were laid in conduits filled with sawdust; and in other places, in conduits filled with pitch. These proved only examples of costly failures; for it is evident their use could be only partial, and no partial adoption of them could be of any value. Parallelling gas-mains, and avoiding cross connections, also failed; and cement joints proved a source of danger. The efforts of the water and gas authorities were supplemented by endeavours on the part of the electricians to discover a solution of the difficulty.

Rail-bonds and feeder-wires (these latter insulated), have already been referred to. These also failed to afford a remedy, though they diminished the damage. Many of the early electric railway constructors connected the rails to the pipes; and some tried reversal of current, with deplorably evil results. In Cambridge (Mass.), the scientific investigation of this problem was first begun by Messrs. Nevons (Water Engineer), Allyn (Gas Engineer), and Morse and Pearson (Electricians). To save the water-pipes, a copper circuit was laid from them to the power-house. The current then left the gas-mains for this new route, destroying them as it did so. The Committee of the Western Gas Association saw no salvation except in the double trolley system—that is a plan by which the current would return overhead, and not pass through rails or pipes. This plan would meet the difficulty. But great risk of fire is involved; and in a strike, for instance, a piece of wire thrown across two trolleys (the supply and return), would cause both to fuse. The three-wire system has also been tried; but with 1100 volts between two wires, it will not commend itself to public authorities. More may be heard of this system. It is under the consideration now of English electricians; but as tried in America, it has not succeeded. It was also suggested to, as it were, pump current from the pipe to the rail by a motor dynamo, so as to make the rail positive to the pipe; but this plan, the author believes, has not been tried. Rail and pipe feeder wires of every kind have been attempted, and all failed.

The views of British electricians upon this very important matter have been recently expressed. Speaking at a meeting of the Institution of Electrical Engineers, on April 8 of this year, Mr. Stephen Sellon, in the discussion

* See "Journal," Vol. LXII., p. 1234.

of a paper on "Traction," described the importance he attached to bonding. "Time was spent," he said, "in discussing whether one dynamo was better than another, or whether one engine was better for a certain purpose; but the point to be considered, and upon which the success of electric traction depended in this country, was the question of leakage. . . . If once they got electrolysis going on in any of the gas or water pipes belonging to municipal authorities, it would mean a death-blow to electric traction in England." He then spoke of the careless bonding done by manufacturers; and gave it as his opinion that they had not yet learned the "mere alpha of the whole business." Mr. W. H. Preece described the leakage on the South London line near Clapham, and the injury done to the telephone wires. Commenting on this discussion, the "Electrician" says, in its leader of April 30 last, that "time spent in discussing dynamos and direct driving was wasted, when the real point at issue was how best to prevent large leakage to earth and the consequent wholesale electrolytic dissolution of our gas and water pipes. . . . If the earth-return is to play such a palmary part, it may perhaps prove worth while after all to fall in with Professor Ayrton's view, and thoroughly insulate the return."

Besides the idea of insulating the return, a plan has been tried by Mr. Harold P. Brown. He considers that it is indispensably necessary to keep the pipes at least one volt negative to the rails, to diminish the current on them, and to make a permanent non-oxidizable low-resistance connection with the feeder wires. His plan may be shortly described as follows: Beside the dynamo battery working the station, a dynamo runs at 12 volts higher. By suitable wires, the negative pole of this is connected to the pipes by a patent method; the positive pole being connected with the trolley as usual. He claims that, by his arrangement, the pipes are always negative to the rails; and the rails can afford the loss, which the pipes could not.

The author's conclusions are that, so long as in any shape or form the return current passes back to the power-house by the uninsulated rails, electrolytic action destructive to gas and water mains will go on; and, further, that proper electric tests made by qualified persons should be regularly applied to determine the electric condition of the pipes. Lastly, it is the duty, and to the interest of electricians to provide for underground pipes adequate protection from electrolytic action; and the gas manager has to observe that these requirements are satisfactorily met.

There was no time for discussion on this (the last) paper presented to the meeting.

The Helios Incandescent Gas-Light.—We learn from a paragraph in "Das Kleine Journal" for the 6th inst. that the German Welsbach Incandescent Gas-Light Company have failed in their action in the German Courts for the suppression of the Siemens-Helios burner of the Helios Incandescent Gas-Light Company. The plaintiffs were non-suited, and ordered to pay the whole costs of the action; while it was further held that the burner in question did not infringe the Pintsch burner patent.

North Wales Curley Cannel.—Elsewhere will be found a letter from the Secretary of the Pontybodkin Cannel Colliery Company, Limited, referring to a statement on the above subject contained in the paper read by Mr. J. Davis at the recent meeting of the Gas Institute. We gave an account of the discovery of this field of cannel in the "JOURNAL" some time ago, while it was in the hands of Messrs. S. Chandler and Sons. It is satisfactory to find, from Mr. Potter's letter, that another good area of the well-known cannel has now been proved; and judging from expert opinion, the field will take some years to exhaust. Mr. N. R. Griffith, who is connected with the Kent coal-field, is the Company's adviser; and as he has had nearly all the cannel in North Wales under his professional direction, they appear to be in good hands.

The London County Council and the Water Question.—In the "JOURNAL" last week (p. 16), we published three of the five recommendations of the Water Committee of the London County Council on the above subject which are now awaiting the consideration of the Council. The first was to the effect that the water supply should not continue in the hands of private companies. The Vice-Chairman of the Council (Mr. Beachcroft) has placed upon the *agenda* a notice of an amendment in the following terms: "That, in view of the reference to the Royal Commission, it is undesirable that the Council should pass any further resolutions affecting the acquisition of the water supply of the Metropolis; and accordingly that the recommendation be referred back to the Committee for further consideration." The report containing the recommendations was brought up last Tuesday; but it was postponed.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 129.)

LAST week was none of the best for the Stock Exchange. Business as a rule was very quiet—rapidly relapsing into its autumn holiday proportions; and the general tendency was decidedly dull and downward. There was a faint flicker of a better turn in the middle of the week; but it quickly went out. Influential factors were adverse. The dragging on of the negotiations in Eastern Europe, and the engineering strike at home, had a bad effect. And then the closing of the Exchange on Saturday for repairs and alterations caused a break-off, which was not without its effect in depriving markets of support. Thus prices have suffered, though not to any considerable extent. The Money Market remains in its old easy condition, and without anything in view to bring about a change. Business in Gas stocks was pretty active; and prices as a rule were good, while one or two small advances in value were scored. Gaslight "A" is an exception; and it would appear to have been the object of contending views and unfounded rumours. The stock went very well at first in response to good buying orders, and rose till 322½ had been touched. But upon these appearing to be satisfied, it fell away without support, and, by the close, it had lost a couple of points. The secured issues also were unusually active; and under the influence of cheap money, they commanded very good figures, though the quotations did not vary. South Metropolitan was only moderately dealt in; but it pushed up another point, changing hands at 145½. Commercials again had a blank week; but the debenture stock was advanced. Two or three transactions were all that the Suburban and Provincial division could provide. But the tone was good; and Brentford rose a point. Of the Continental group, Imperial was the only one to show the slightest disposition to activity. It stood very steady; and the best figure was obtained on the closing day. Among the rest, Monte Video made an advance; but Belgrano fell back. Business in the Water Companies was at about its normal level. But the good tendency observed the previous week was maintained; and a few moderate improvements in value were effected.

The daily operations were: Business in Gas at the start on Monday was quiet, at about the old figures. South Metropolitan advanced 1. Matters became much more lively on Tuesday; Gaslights and Imperial being quite brisk. Brentford old and Gaslight "A" rose 1 each. In Water, Chelsea improved 4; and Grand Junction, 1. Wednesday was another active day; business being for the most part in Gaslights. The "A" moved up 1 more; and Monte Video advanced ½. In Water, West Middlesex improved 2. With Thursday came the check to Gaslight "A," which was put down 2. Commercial debenture rose 1½. Transactions were numerous on Friday, for the most part in Gaslight "A," which was lowered 2 more. Belgrano fell ¼. In Water, East London rose 1½. The Stock Exchange was closed on Saturday.

ELECTRIC LIGHTING MEMORANDA.

Meeting of the Municipal Electrical Association in Manchester—Peculiar Constitution of the Association—Consultants and Resident Engineers—The New Order—The Beseting Evils of Professionalism.

THE Municipal Electrical Association, which, as the title is intended to indicate, is composed of electricians in the service of local authorities, met last month in Manchester, under the presidency of Mr. C. H. Wordingham, the Electrical Engineer to the City Corporation. It is an irritating trick of this society to call its meetings "Conventions," after the American fashion. We suppose that if the Association ever organized an electrical exhibition, they would not be content to give the affair any other name than that of "exposition," following the same model. One of the particular points of modernity indulged in by the Association is the transference of the President's address from the beginning to the end of his term of office; so that on the present occasion Mr. Wordingham had to express his thanks just as he was vacating the chair for the honour done him by his colleagues. It is to be supposed that there is some reason for these peculiarities other than the somewhat childish desire to be different from most other technical societies, which may in a measure inspire one of the youngest of such organizations. The municipal electricians may be reminded, however, that it is far easier to be eccentric than it is to be original, and that no tricks of manner or strange phraseology will serve them in creating for themselves a good corporate reputation. As a matter of fact, they do not need these artificial aids to distinction. The municipal electricans of the United Kingdom are a body of technicians of whom any country might well be proud. It is only necessary to refer to the address of Mr. Corbet Woodall to the Institution of Gas Engineers to find sufficient evidence of the estimation in which those who follow the gas industry hold their younger compeers in the trade in artificial light. The proceedings of the Municipal Electrical Association in Manchester amply justified the opinion

held by Mr. Woodall as to the quality of the young men who have embraced and are now occupied in this branch of the profession of engineering.

Mr. Wordingham's address—not inaugural but valedictory—was an eminently sensible composition, specially well directed to the elucidation of those questions of which the Association was intended to take cognizance. It is not a new engineering society for which there is no need at the present time. It is based on the idea of an organization to take account of the administrative and commercial aspects of electricity supply as carried on by local authorities; and for such an Association there is plenty of work to do in helping to settle the practice of this new field of municipal activity. Very wisely, upon Mr. Wordingham's own initiative, members of corporation electric lighting committees are admitted to membership of the Association, and are elegible to participate in its management. This is a peculiarity that strongly marks off the Association from every other society of the kind. In this particular connection, the plan is to be commended. Members of local authorities badly need to be educated in matters electrical—not in the science, of course, and hardly in the technics, but in other equally important branches of the general subject. For one thing, as Mr. Wordingham was careful to point out, municipalities require to be much better instructed as to the true status of their electrical engineeers.

At the beginning of municipal electricity supply, the salaries offered to, and accepted by, resident electrical engineers were absurdly low. They were utterly beneath the deservings of really competent men; but they were taken because there was, and still is, a numerous body of half-trained students desirous of getting the chance of gaining experience on any terms. There was another reason for this state of things, to which Mr. Wordingham did not refer. It was that the municipal undertakings were always schemed and carried out by consultants of more or less credit and renown, who had the responsibility for doing everything up to a point. None of these gentlemen possessed any experience of the working of electricity supply undertakings; but they were celebrated as advisers of local authorities contemplating going into this business, and they did not want too clever resident electricians. Moreover, the municipalities did not see, if they paid their consultants for everything, that the station engineers need be able to do much more than keep things going. Thus for a time the resident appointments ruled poor.

Meanwhile, the Metropolitan and other important electric lighting companies found it expedient to drop the consultant as speedily as possible, and train up executive staffs of their own. The municipalities are now following suit. It is being discovered that the old distinction between the engineer and the works' manager must be abandoned, at any rate for all important undertakings; and thus the electricians are repeating the experience of the followers of the gas industry. Naturally, the process is slower in some places than in others. The consultant is by no means disestablished yet, nor can he be. As in the gas industry, however, the consultants of the older, unpractical order are being replaced by men who have a more particular knowledge of the thing that has to be done; so that the tendency is for the successful resident engineer of one establishment to be asked to help in founding another, or looking after a smaller concern.

Mr. Wordiugham very wisely cautions his colleagues against two of the besetting evils of professionalism, to which, it may easily be understood, the usually young municipal electrician is peculiarly susceptible. One is simple "bumptiousness," otherwise priggishness and conceit of culture. He says he has met some of these gentlemen "who seem to take an altogether exaggerated view of the importance of their office; appearing to think that all other departments of the corporation are insignificant compared with their own, and that the officials connected with them are hopelessly unenlightened and behind the times." We have all met gentry of this kind, in gas as well as in electricity; and extremely offensive they are. Their light is converted by their own self-conceit into the most hopeless darkness; nor does their small cleverness avail to enable them to perceive the disgust they inspire in their associates. The other mischief is the temptation, into which so many struggling professional men are prone to fall, to advertise themselves, and seek their individual advantage at other people's expense. "The old traditions handed down by the civil engineers who have made the reputation of Great Britain as the foremost engineering country in the world, are openly scoffed at; and a large section of men appear to see nothing degrading in canvassing and advertising, and in joining in a competition more worthy of an enterprising cheap-jack than a member of an honourable profession." Mr. Wordingham went on to caution his hearers against the minor, but still vexatious, weakness of being liable to be led away by a fashion in technical matters. Fashions rule here as in other human affairs. "A type of plant, a dielectric, a system of working supposed to be new, is introduced. It operates successfully in one or two cases. Immediately there is a chorus of praise. Every other method and every other type of plant is condemned. The fashion is set; and everyone must rush to make alterations, or he is supposed to be behind the times, without intelligence, and ignorant." From all of which it is to be gathered that Mr. Wordingham is truly a man of leading as well as of light.

THE "WEARDALE" AND OTHER GAS-FURNACES.

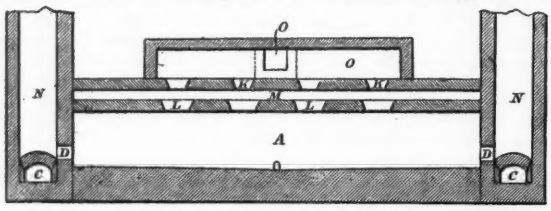
Very little has been published of late concerning the subject of the improvement of gas-retort furnaces, which a few years ago was much in evidence in our columns. It is to be gathered from this suspension of discussion on the subject, not exactly that its interest is exhausted or that its importance has declined, but rather that the practice of gaseous firing has entered upon the stage of the commonplace, where there is little occasion for disputation. The merits of the gas-furnace are widely appreciated; and the conditions upon which these may be manifested in various degrees are well known. The echoes of the once lively controversy respecting the part played by "regeneration" in improved furnace working have died away; the depreciation of the value of coke during the last few years having largely discounted the mere economical aspect of the new system of firing retort-settings. It would be a mistake, however, to conclude that because, when gas engineers meet together in conference, they talk less than formerly about retort-furnaces, therefore they are indifferent to the study of the problems of pyrology. In many, perhaps the majority, of the gas-works of the United Kingdom, the construction and working of the retort-furnaces have been brought to a high standard of excellence as a fruit of that excellent way of progress—the method of "trial and error"—which is the immemorial high road of improvement. And the effort is still going on. At the Old Kent Road station of the South Metropolitan Gas Company at the present moment an interesting development of the gas-furnace may be seen in operation. This is an arrangement whereby one large generator situated outside the retort-house makes gas for distribution to seven or eight of the largest settings of retorts. The advantages to be looked for, and the drawbacks to be expected, in the case of such a plan are obvious to all who are familiar with retort-house management. But the fact that the arrangement is actually being extended to several of the houses that are being made ready for next winter, is fair evidence that the balance is really to the good.

Some further light upon the capabilities of gas-furnaces in general is thrown by some statements respecting the "Weardale" furnace, offered by Mr. H. W. Hollis, the General Manager of the Weardale Iron and Coal Company, in a paper read before the Iron and Steel Institute. Mr. Hollis worked with a view to the improvement of the re-heating furnaces used in iron-works; but his discoveries are susceptible of a wider application in capable hands. He describes his original object as being that of dispensing with regenerating chambers altogether, on account of their cost; obtaining continuous working without reversing the course of the flame; and getting rid of the disadvantages attendant upon frequent stoppages for cleaning or renewal of the brick checker-work. The broad principle upon which his perfected furnace is constructed is "the introduction of a gas-flame through, and surrounded by, a stratum of highly heated air in the roof of the furnace." His first trial was with a model furnace 4 ft. by 3 ft., with the gas introduced through a single 3-inch pipe in the roof arch; cold air being admitted through four holes in the arch close to the gas inlet, and the flame passing through three outlet ports at each end into an external flue leading to an iron pipe serving as the chimney. The interior of the little furnace was speedily brought to a bright red heat, and this without any heating of the air brought in to support the combustion of the gas. The next improvement was the addition of a rudely constructed outer roof, with a space between the two roofs which constituted a rudimentary hot chamber for the air. By this means a considerable increase of temperature was attained; and the experimenter felt himself upon the right track. The next trial was on a bolder scale. It was a furnace 7 feet square; the roof being formed of two concentric 9-inch arches, with a 9-inch space between. The back wall also was made double; and the air for combustion was admitted across the ends of the furnace into the space between the walls, whence it passed into the roof space. First, however, the air had to enter through fire-clay tubes, round which the effluent heat from the furnace circulated on its way to the chimney. These tubes failed and were dispensed with. Various forms of "burner" for the gas were also tried, with the object of ascertaining the effect of splitting up the currents of gas and air. It was found that there was no advantage in breaking up the inflowing gas by any tubular arrangement of burner; all that was necessary being to surround the downward-pointing gas inlet by an inflowing current of highly-heated air. Mr. Hollis was very candid in recounting his failures and their causes; but we are only concerned with the gaseous firing arrangements as tried and finally adopted on the larger scale.

Mr. Hollis remarks—and the statement is interesting in connection with the Old Kent Road arrangement already mentioned—that "two or more furnaces, fed from a common gas supply, will work more uniformly and more economically than single furnaces separately supplied with gas. It is a great advance to have a battery of producers from which the gas may be led wherever it is required within reasonable distance, on account of the facility with which coal may be brought to, and ashes taken away from, the producers. The distance to which producer gas may be taken in underground flues, without appre

ciable loss of its initial heat, is much greater than is generally supposed." In Mr. Hollis's system, the gas is required to be as hot as possible on its arrival at the place of combustion. In the case of his largest furnace, the distance from the centre of the furnace to the most distant gas-producer is 260 feet; and the whole of the interior of the underground flue, which is 7 ft. by 3 ft. in cross-section, is maintained at a red heat. This is by way of introducing the description of the two large furnaces recently erected at Weardale, full particulars of which appeared in "Engineering" for the 25th ult.

In these furnaces, the principle of construction already specified is followed. There is a heating chamber, the particular use of which is for our purpose immaterial, with a double roof of arch bricks. Above the upper arch is the gas-flue, opening downwards, with ports of the ordinary construction, into the space between the arches where the hot air flows. Immediately and directly under the lower arch are the flame ports, where the gas and air enter into combustion. The outlets are at the floor level. The following section sufficiently illustrates the central idea of the arrangement. A is the heating chamber,



in this case measuring 30 ft. by 10 ft.—thus not widely differing in size from a through retort arch; O is the gas-flue from the producers; K are the gas-ports or nozzles; M is the hot-air space between the two arches; L are the flame nozzles leading into the heating chamber; D, the outlets for the spent furnace gases. N are the chimneys; and C, the cold-air inlet flues, which lead first of all into the double back of the heating chamber before entering the double roof.

It will thus be seen that the gas enters downwards into the furnace in a column which is entirely surrounded with highly-heated air. The producer pressure and the chimney draught together cause the flame to enter the chamber at a considerable velocity. The flame is established before entering the heating chamber, where it burns at an intense white heat which necessitates the use of blue glasses for inspecting the interior. Mr. Hollis speaks of cinder lying in "shining pools like water" upon the floor of these furnaces. The supply of gas to the furnaces is so regulated by a valve that the flame is just long enough to pass out at the outlet ports. When a flame-banner appears at the top of the chimney, it is a sign that fuel is being wasted, while the temperature of the furnace actually falls. Yet, with whatever care the operations are conducted, there is of necessity a large quantity of heat lost—probably not less than one-half of the calorific value of the fuel. Some of this it is suggested might be recovered by making the waste gases raise steam in water-tube boilers.

All this is highly suggestive, and is calculated to arouse much cogitation in minds habituated to the working of furnaces, such as retort-settings, in a particular way which is never departed from. The most remarkable feature in Mr. Hollis's arrangement is the extraordinary effect ascribed to the device of *surrounding* the current of gas with an envelope of hot air. It is to Mr. F. Siemens that the world owes the demonstration of the necessity of allowing flames to burn themselves out before the gases in combustion are permitted to strike against any solid substance. But, to the best of our information, he did not contemplate the downward burning of flames in the manner suggested by Mr. Hollis—that is, with a complete surrounding of the heated supply of secondary air. More is now known of the structure of flames, through the investigations of Smithells, Lewes, and others, than was understood at the time when Siemens did his greatest work in this connection; and it is greatly to be desired that the validity of this presumed discovery of Mr. Hollis should be tested independently.

The record of this new work, however, goes to show that the existing stock of knowledge of the capabilities of gas-furnaces is far from being exhaustive. It will come as a surprise to many who plume themselves on their knowledge of furnace working that there is as much in the proper burning of gaseous fuel as in the production of it; but this seems to be the "moral" of Mr. Hollis's tale. At any rate, it is safe to advise the designers of gas-retort furnaces to look round occasionally and see what is being done in other fields of pyrological science and practice. The extent of the saving of fuel that has been effected during the last few years in the working of iron, steel, and glass furnaces is enormous; and it has been secured by the intelligent study and application of the possibilities inherent in the gas-furnace. There has been no "royal road" to success in this line of effort. Over and over again, systems and plants conceived and laid down in accordance with what was imagined to be the dictates of the soundest science have disappointed their designers; and such permanent success as has been achieved has been mainly due to plodding experimenters who, like Mr. Hollis, began at the beginning, and did their best to follow up the clues that observed results put into their hands.

NOTES.

Captain Abney on Light and Colour Perceptions.

At the Royal Society, Captain Abney has explained a new method devised by himself for measuring the sensitiveness of the retina to light and colour. The author treated first of the extinction of the sensation of light on the centre of the retina. The reduction of the intensity of the light falling on the illuminated spot was made with a new apparatus consisting of a gelatine wedge bent round so as to form a ring. The readings of this instrument are proportional to the logarithm of the light-intensity passing at the point. It is found that the smaller the spot of illuminated surface, the more easily the apparent intensity of the light falling upon it is diminished; and there is a simple formula for connecting the size of the spot with the amount of obstruction required to just produce the sensation of no light. Again, since a large and a small area having the same actual illumination appear to be of different brightness, an investigation was made which resulted in establishing a very simple law connecting the two data. The degree of reduction of a coloured ray required to extinguish the sensation of colour was next measured with areas of different dimensions, and it was ascertained that again the intensity of the coloured light was connected with the size of the spot by a simple expression corresponding with that for total extinction. The exponential coefficients, however, differ—indicating that the phenomena of light and colour are not connected together in the manner that might be expected. The author finds that all colour fields in the retina are of the same form; the extent depending wholly on the illumination and the apparent size of the source of light. Captain Abney points out that there are difficulties in the way of reconciling his results with either the Young or the Hering theory of colour vision; and he suggests a modification of the accepted theory of light and colour which may explain the connection between the two.

Electrical Power Transmission.

The employment of electricity for actuating retort-house and other machinery in gas-works has not yet been brought within the scope of ordinary practice; but, according to information laid by Professor C. H. Benjamin before the Hartford meeting of the American Society of Mechanical Engineers, the matter will repay inquiry. The author presented a paper on the loss of power in transmission in factories before a previous meeting of the Society; and the discussion upon the paper served to bring out the opinion of many members that the best way to cure the friction losses of belts and shafting is to substitute electrical transmission. Hereupon Professor Benjamin undertook to look further into the subject; and he now claims to have established, by reference to good examples, that while the first cost of electrical machinery is usually greater than that of shafting and belting, the saving of power in most machine shops would pay for the additional cost of the electric plant in from one to five years. He contends that such conclusions, vague as they are, are about all that exist to guide us at present. It is pointed out that, in connection with questions of power transmission, there are other considerations to be regarded besides those of first cost and relative efficiency. Professor Benjamin wisely shows—and the lesson is capable of expansion beyond the particular application—that neither the cost nor efficiency of a special description of plant is sufficient to determine its value without reference to the major consideration of the effect upon output. Professor Benjamin speaks highly of the electric crane, which he considers the most convenient and efficient carrier yet developed. He predicts for it increasing popularity for the shifting of both heavy and light loads.

The Weight of Material in Power Transmission.

In the "Engineer" for the 2nd inst., there appeared an article discussing the problem of power transmission, from the elementary standpoint of the volumes and weights of material employed in the transmission by various methods. Beginning with the simplest and most anciently-employed means of transmitting power—by the lever—it is demonstrated why this method is impracticable except for the short distances through which power has to be transmitted from one to another part of the same machine. The next method investigated is that of torsion shafting, which is illustrated by the case of 50 feet of shafting transmitting 150-horse power at 90 revolutions per minute. Since shafting is invariably used along with either toothed or band gearing, the requirements of the latter are discussed. It is remarkable that in good surface condition of both belt and pulley, and when properly tightened up, it is very easy to get the driving pull, which is the difference between the pulls on the tight and slack sides, equal to two-thirds or three-quarters the pull on the tight side. But in actual workshop practice such conditions are rarely found; so that not even half the tight pull can be reckoned upon. Where steel rope driving is practicable, the weight of the transmitting medium is only 1-25th of the weight of the best leather belting. Hydraulic and compressed air transmission occupy a different category from the foregoing; and it is difficult to reduce these working fluids to the standard of weight of material employed, as part of it is actually consumed while the rest remains immobile in the form of the pipes used for carrying it.

TECHNICAL RECORD.

SOCIETE TECHNIQUE DU GAZ EN FRANCE.

Papers Read at the Annual Congress.

An abstract of the Inaugural Address of M. Ph. Delahaye, the President of this Society, was given with our report in the "JOURNAL" for June 29 (p. 1495) of the business proceedings at the annual congress held in Paris on the 15th and 16th ult. We are now able to give abstract translations of the technical papers, which were less numerous, but not less interesting, than those read at last year's congress at Clermont-Ferrand.

THE USE OF THE KUDLICZ GRATE FOR BURNING BREEZE, CINDERS, AND OTHER FUEL RESIDUES.

The grate invented by Herr J. Kudlicz, of Prague, was briefly described and some results obtained with it at the Nuremberg Gas-Works recorded, in the "JOURNAL" for March 23 last (p. 654). It was dealt with at the above meeting in a paper by M. Jouanne. The grate was introduced into France about three years ago. It presents to gas-works the attraction of a means of disposing to good purpose of the surplus of breeze, which in many instances is an almost unsaleable product. Many attempts have been made previously in France to utilize breeze as a fuel. As early as 1886, M. Pettre gave results of trials of a mixture of 3 parts breeze and 2 parts coal, for the heating under forced draught of a set of six gas-retorts. In 1890, he stated that he had used for a similar purpose a mixture of 1 part small coke and 4 parts breeze; and one of 3 parts coal dust and 7 parts breeze. The consumption of the first of these two mixtures amounted to 23 per cent., and that of the second to 30 per cent. of the coal carbonized. The residues from coal-washing at the pit's mouth had even earlier been used under natural draught as fuel at the St. Etienne and Firminy Gas-Works. At Angers, coal dust and breeze had been used for heating the furnaces; and such a mixture was even tried under a forced draught of hot air. In 1890, it was stated that similar mixtures had been used at both the Châlons-sur-Marne and Saint-Quentin Gas-Works. Since that year, attention does not appear to have been turned sufficiently to the utilization of breeze as a fuel, notwithstanding that it is generally a drug in the market. The Kudlicz grate affords means by which gas-works may use breeze as fuel for generators, boilers, &c. A good and steady market for breeze might be secured by the general adoption of this grate in large industrial centres.

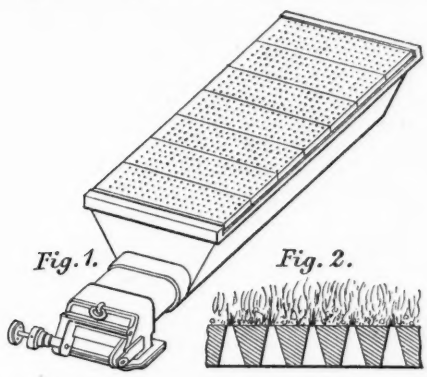


Fig. 1. *Fig. 2.*

The Kudlicz grate—of which the simplest pattern is shown in fig. 1—is designed to work under a low-pressure blast. It consists essentially of a number of perforated cast-iron plates, supported above a close iron blast-chamber, connected in front to a case enclosing the nozzles of the blastpipes or injectors. This case is either furnished with holes on its face for the admission of air, or is connected at foot to an underground air-conduit. Steam is supplied to the injectors from a small pipe, provided with a regulating cock. When the steam is turned on, air is drawn in from the conduit or the air-inlet holes, and forced under pressure into the blast-chamber beneath the grate. A mixture of air and steam is thus driven through the perforations in the plates on to the bed of fuel, which it fans into vigorous combustion. The steam is said to undergo dissociation in its passage through the hot fuel; and the oxygen thus liberated is stated to intensify the combustion, while the calorific effect of the hydrogen also set free is added to that of the fuel. The perforations in the plates are usually of conical shape; and their diameter is about 0·15 inch at top, and 0·7 inch at bottom. There are about 128 perforations per square foot area of the plates. Both the upper surface of the plates and the shape of the perforations may be varied. The simplest type is shown in a cross-section of a plate in fig. 2. The plates themselves are about 9 inches in width, and run across the furnace upon a suitable frame. The grate is set either horizontally or inclined, according to the nature of the furnace. One arrangement suitable for boiler heating is shown in fig. 3. The case which covers the injectors has a hinged lid, by means of which they may be inspected, and obstructions of the perforations in the plates removed by aid of a stiff wire. The lid also permits the withdrawal of the little ash which falls through the perforations into the blast-chamber. The plates are cooled by the blast of air and steam, and so do not wear out rapidly. The fire is regulated simply by turning the steam-cock, and thereby altering the supply of steam to the injectors, and consequently the indraught of air. The steam should not be entirely shut off, even while cleaning the fire; but a slight current of air and steam should always be maintained, in order to keep the plates cool, and to prevent clinker adhering to them, and ash falling

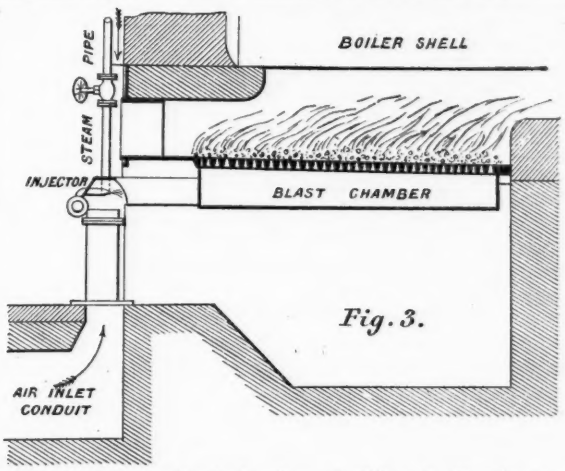


Fig. 3.

in quantity into the blast-chamber. In this as in other furnaces with forced draught, the lighter particles of ash are carried away with the products of combustion; but they are for the most part caught and thrown down by the baffle at the back of the furnace. When the fire is burning properly, the ash is thoroughly burnt, and is fine and whitish. The lower cost of the fuel burnt by this arrangement of grate more than compensates for the rather more frequent cleaning of the fire which may be necessary owing to the greater production of ash by the inferior fuel. The steam required for the blast is quite a small item of expenditure.

At Pont-à-Mousson, a foundry and blast-furnace company have constructed a number of Kudlicz grates, for the combustion of breeze exclusively. This company state that 1 lb. of breeze burnt on these grates evaporates from 7 to 7·4 lbs. of water—a result nearly equal to that given by good coal burnt on ordinary fire-bars. Furnaces with forced draught have lately been charged with causing flames which act like so many blow-pipe jets on the surfaces which they strike. But the injuries to boiler plates which are thus attributed simply to forced draught, are in reality due to hearths of bad design, and to too high blast pressures. With the Kudlicz grate, a pressure of only about 1 inch of water is used; and the blowpipe-like jets cannot be produced thereby. In fact, no injury to boiler plates has been traced to the impingement upon them of jets of flame in any one of upwards of 2000 instances in which Kudlicz grates have been employed. M. Schmidt has given results of trials made during August, 1895, at Amiens with a semi-tubular boiler having 1044 square feet of heating surface. With the Kudlicz grate, he found that 67·5 per cent. of the theoretical, or 70 per cent. of the available, calorific power of the fuel was utilized.

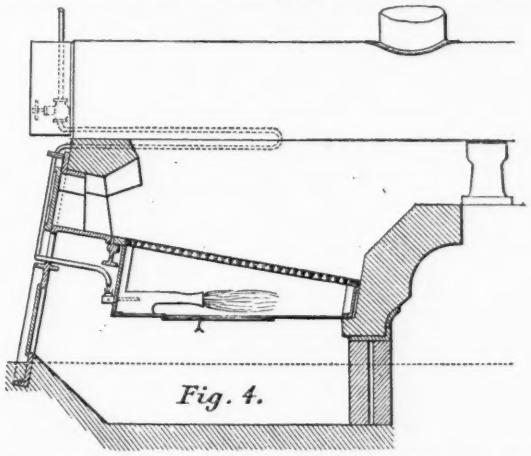


Fig. 4.

The average composition of the mixture used by him was 7 of fine to 1 of coarse fuel. The pressure in the blast-chamber averaged only 0·45 inch, and never exceeded 1·2 inches. The average consumption of fuel amounted to 0·266 lb. per square foot of heating surface. A pound of dry fuel was found to evaporate 8·07 lbs. of water at 32° Fahr.

The Kudlicz grate has been satisfactorily working for two

years at the La Villette works of the Paris Gas Company. It is used in a tubular boiler, of the furnace of which a longitudinal section is shown in fig. 4, and consumes breeze. By means of this grate, both the Eastern and Western railroads of France use as boiler fuel in their shops the residues from the locomotive smoke-boxes. MM. Solvay et Cie., at Salins-de-Giraud, have a number of boilers with internal furnaces of the Lancashire type, fitted with the Kudlicz grate.

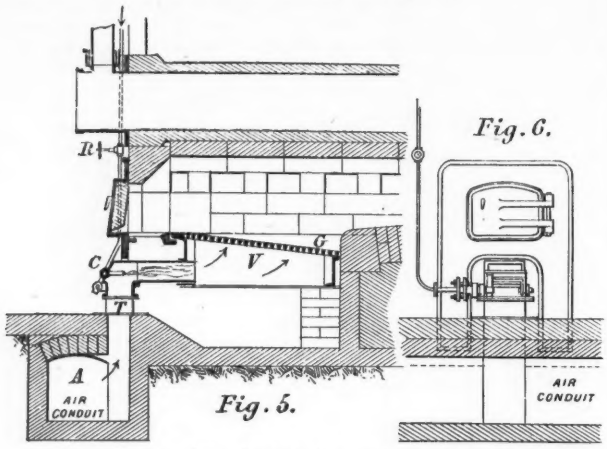


Fig. 5.

Fig. 6.

The grate is also adapted for use in metallurgical or other high temperature furnaces. Fig. 5 is a longitudinal section, and fig. 6 a front elevation, of a gas-retort furnace fitted with the grate, and designed to heat a setting of five or seven retorts. In this design, the air supply to the blast-chamber Y is drawn up through T, from the underground conduit A. A narrow copper tube, provided with a regulating cock R, conveys steam to the injector C. The system could be adapted to regenerative settings by causing the injector to draw the air for the blast from the hot-air passages of the setting, instead of from the underground conduit shown. Such an alteration to adapt a setting for use with the Kudlicz grate, should be inexpensive. The grate would not be altered in width, but would need to be carried rather further back. A steam-pipe to supply the injector would have to be fitted, and the front of the furnace altered to the pattern shown in fig. 6.

A furnace of this type is to be tried shortly ; and the result will show if the Kudlicz grate is of practical value for heating retorts. In the meantime, its proved utility for boiler-furnaces gives an opening for the profitable disposal of breeze and similar residues which have hitherto been a great encumbrance to gas-works. M. Poillon, of Amiens, has summarized the advantages of the Kudlicz grate. He claims for it: (1) Freedom from wear and tear; (2) simple manipulation and easy regulation of the fire; (3) utility for all descriptions of boilers and furnaces; (4) preservation of boilers, through tongues of flame being avoided; (5) suppression of black smoke; (6) utilization of the poorest waste combustible residues the value of which is very much less than that of ordinary fuels, and therefrom an economy which repays in less than a year the cost of installing the grate.

A HINGED SCOOP FOR CHARGING RETORTS.

Strikes of stokers in recent years have rendered specially welcome any apparatus which frees a gas-works from dependence on a special staff of workmen. Scoop charging has now been generally adopted; and the object of the scoop described by M. Laurain is to enable the charging of the retort to be performed in a single operation. Hitherto two small scoops have been used in quick succession ; and thus additional strain has been put on the stokers, and a certain amount of time lost between the introduction of the two scoops. The hinged scoop obviates these disadvantages of the ordinary scoop. It is used in conjunction with a stirrup, supported by a travelling carriage which runs along a rail fixed parallel to the front of the bench of retorts. The scoop itself consists of two quadrants of a cylinder about 9 feet in length, and is of steel about 0·16 inch thick. Its handle is formed by two rods about 4 ft. 6 in. in length, and overlapping the scoop for about 1 foot. These rods are attached to a cross-piece, which forms a T-shaped handle. They are about 4 inches apart throughout their length, and connected by braces in which they are free to turn. One quadrant of the scoop is rigidly attached to each rod; so that when the rods are revolved in opposite directions through about 90°, by means of levers attached to them near the T-handle, the quadrants come apart, and the contents of the scoop are discharged through the opening that is thus made in its bottom. The quadrants are suitably stiffened near their points of attachment to the rods. A cross-section of the scoop near its handle end is given in fig. 7, and shows the stiffening, and the method of attachment to the rods. The dotted lines give the position of the quadrants after the rods have been rotated and the contents of the scoop discharged on the bottom of the retort. The extreme width of the scoop is about 16 inches, and the depth about 6 inches. The scoop and stirrup weigh about 2 cwt. It requires three men for its manipulation. One attends to the stirrup support; and the scoop, previously filled and raised to the proper height, is pushed into, and withdrawn from, the retort by the other two, who thereupon close the lid of the retort. Two men fill a scoop, while the third removes the lid of the next retort. From 30 to 40 seconds is the time occupied in charging each

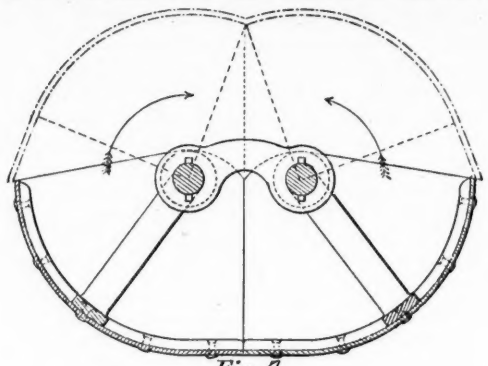


Fig. 7.

mouthpiece with this scoop. It has been in use at the Troyes Gas-Works since 1888, and has given satisfaction.

ADAPTING EXISTING RETORT-HOUSES TO MECHANICAL STOKING, AND MECHANICALLY QUENCHING AND REMOVING THE COKE.

M. Leclaire dealt with this interesting subject. A scheme for the conversion of transverse to longitudinal benches of retorts in existing houses is given, because transverse benches are unsuitable for the employment of mechanical stokers. The economy of space effected is said to increase the productive capacity of the house by 10 per cent. The scheme includes the introduction of settings of twelve retorts. One of these

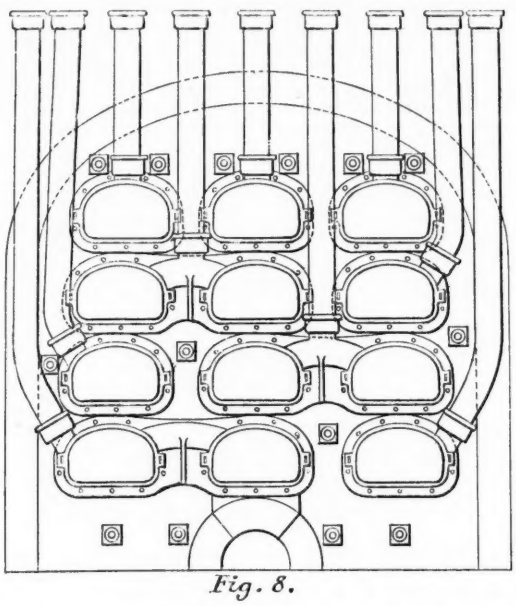


Fig. 8.

settings is shown in elevation in fig. 8. Six retorts are connected in pairs; and one ascension-pipe does duty for a pair of retorts. The retorts are internally 25 inches wide and 16 inches high. The extreme width of one such setting is about 12 ft. 4 in. The twelve retorts are capable of carbonizing in 24 hours 11·8 tons of coal. The stoking machinery adopted in the scheme is Foulis's; and the coke is handled and quenched by means of De Brouwer's appliance, which was described in the "JOURNAL" last year.* The charging-machine is fed from a hopper, to which the coal is raised by an elevator. It is computed that the cost of installing the whole of the mechanical appliances required for 33 settings of twelve retorts will be extinguished by the saving on labour in 30 months' full work; or in 60 months, if the average production is only one-half that of which the settings are capable.

Petroleum in Venezuela.—It is expected that petroleum will shortly be worked in Venezuela upon a large scale. The Venezuelan petroleum fields are situated near the Rio San Miguel, a tributary of Lake Maracaibo; and they are stated to present a close resemblance to those of Pennsylvania.

* See "JOURNAL," Vol. LXVII., p. 23.

REGISTER OF PATENTS.

Wet Gas-Meters.—O'Connor, H., of Edinburgh. No. 9591; May 6, 1896.

This is the meter arrangement referred to by the patentee in the paper he read last July before the North British Association of Gas Managers—the object aimed at being "to enable the water-level in a wet gas-meter to be raised or lowered at will, and with absolute exactitude, in order to compensate for variations in thermometrical and barometrical pressure, or for any other purpose."

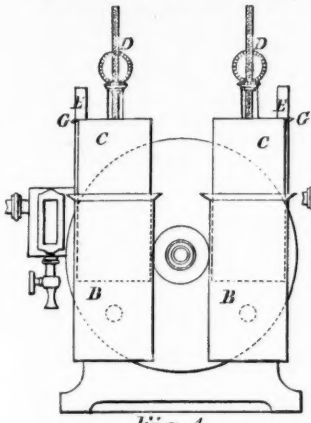


Fig. 1.

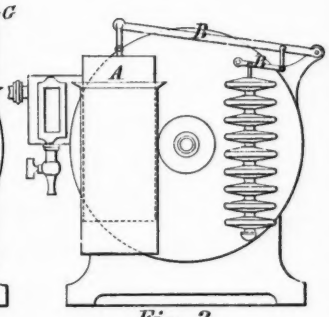


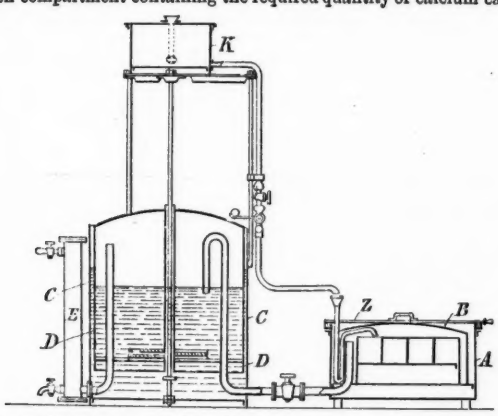
Fig. 2.

Upon the meter shown in fig. 1, there are fixed one or more water-chambers B, having each a connection with the water-space in the meter below the lowest water-line. Each chamber is fitted with a plunger or piston C, raised or lowered by a rack and pinion or screw-gearing D, actuated by a thumbscrew. In connection with each plunger is a vertical scale E, graduated to represent the scales of the barometer and thermometer respectively; or where a single plunger only is used, graduated to represent the "tabular number" provided by the Metropolitan Gas Referees—equivalent to the combination of the readings of both instruments. To the plunger is attached a pointer G, indicating upon the scales. The capacity of the plungers is such that, when the pointers are raised or lowered so as to indicate a given temperature and barometrical pressure, the level of the water within the meter is raised or lowered so as to cause such greater or less quantity of gas to pass at each revolution of the meter-drum as will exactly compensate for the expansion or contraction due to the given variation from the normal temperature and barometrical pressure.

Alternatively, the same purpose is accomplished (as in fig. 2) by attaching to the plunger A, by suitable levers B, a hermetically sealed vessel C of such capacity—ascertained by calculations in each case—and of such shape, that the expansion or contraction of the gas contained in it will cause such a movement of the levers and plunger as will raise or lower the water-level so as to cause such greater or less quantity of gas to pass at each revolution of the meter-drum as will exactly compensate for the expansion or contraction due to the given variation from the normal temperature and barometrical pressure. The plunger is made of such weight that it is of about the same gravity as the water in which it is immersed.

Production of Acetylene.—Redfern, G. F.; a communication from La Compagnie Continentale d'Éclairage par le Gaz Acetylène et ses Applications Industrielles, of Paris. No. 15,064; July 7, 1896.

According to this invention, the generator A is provided with a cover B, having a hydraulic joint, and being formed of a cylinder or bell held in place by a pivoted bar Z. The receiver is divided into a number of compartments, communicating with each other in such a manner that the water introduced into the first compartment for the production of the gas successively overflows from one compartment to another—each compartment containing the required quantity of calcium carbide



for the production of a certain volume of gas. The holder into which the acetylene flows is constructed of an outer cylinder C, in which a cylinder D is guided by a central rod. The pipe which enters the holder is bent so as to dip into the water, in order that the gas may be washed by bubbling through it. The gas passing out is conducted to the mains through a purifier E.

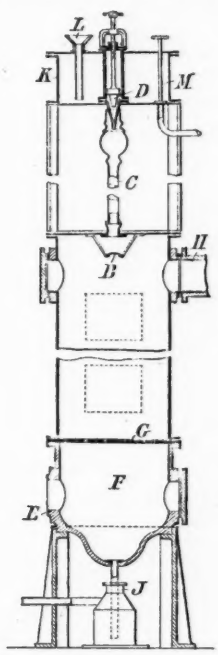
The water necessary for the manufacture of the gas (contained in a tank K) is conveyed to the generator in the following manner: A pipe, provided with a cock, conducts the water into a funnel on a syphon, which carries it to the first compartment of the generator A. The plug of the cock is provided with a lever and a weight arranged so as to keep it open. When the cylinder D of the holder is in its lowest position, the weight opens the cock, and allows the water to flow from the tank K into the generator. The water entering the first compartment, produces a certain quantity of gas, which passes into the cylinder D and raises it, thereby acting on the lever of the cock and closing it, so as to shut off the supply of water, and avoid over-production of gas. When, by reason of the consumption of gas, the cylinder falls, it ceases to act on the lever of the cock, which is thereby again opened by the action of the weight, and permits a fresh quantity of water to flow into the generator.

The water flows from the first compartment into the second, and so on; the flow being effected automatically by successively opening and closing the inlet-cock. When the carbide contained in one compartment of the generator is used up, the water which flows into this compartment overflows into the next, acting on the material contained therein; and this is continued until all the carbide in the generator is used up. The water-tank shows on a gauge the consumption of gas from the time the apparatus was charged, and thereby the quantity of carbide remaining in the apparatus.

When passing from the holder, the gas flows to the bottom of the purifier E, which is divided into two superposed compartments; the lower compartment containing pieces of pumice stone or other suitable spongy material, impregnated with a saturated solution of sulphate of copper, or other soluble salt—such as lead acetate, silver nitrate, &c., which forms a phosphide of copper, or of the metal contained in the solution with any phosphoretted hydrogen in the acetylene.

Removing Gaseous Iron Compounds from Water Gas.—Strache, H., of Vienna. No. 16,984; July 31, 1896.

As is well known, water gas contains iron carbon-oxide or iron carbonyl, which, on burning, produces iron oxide, and thus deprives incandescent mantles when used with water gas of their illuminating power. The present invention relates to apparatus enabling the water gas to be purified by bringing it into contact with concentrated sulphuric acid over as large a surface as possible—first drying the gas by the acid which runs away after having served for taking up the iron. This large surface of contact is obtained by dropping the acid on to pumice stone, over which the gas is caused to pass in a scrubber lined with lead. The desiccation of the gas is effected by the acid which runs away, by following the reverse-current principle; since the dropping acid flows from above downwards over the pumice, while the gas passes from below upward.



In the arrangement shown, the gas enters by the inlet E into a chamber F, and passes up through the perforated false bottom G into the purifying chamber, where it comes into contact with the acid, and leaves through the outlet H. The gas is thus first dried in the lower parts of the apparatus by dilute acid, and, in rising, continually meets layers of acid of gradually increasing concentration; being finally purified in the uppermost parts of the apparatus, in a perfectly dry condition, by fully concentrated acid.

Since concentrated sulphuric acid, says the patentee, can free almost unlimited quantities of dry water gas from iron, the quantity of sulphuric acid required for cleansing is determined entirely by the necessary desiccation of the gas. In this apparatus, the sulphuric acid that flows away through the liquid seal J at the bottom of the chamber F is diluted with more than an equal volume of water. Since, now, 1 cubic metre of a gas saturated with moisture at ordinary temperatures contains about 2 volumes per cent. (= 20 litres, or 16 grammes) of water-vapour, 16 grammes of concentrated sulphuric acid will suffice for drying and purifying 1 cubic metre of water gas; so that for each 100 cubic metres of water gas, only 1·6 kilogrammes of concentrated sulphuric acid are required. For example, in an apparatus for purifying 100 cubic metres of water gas per hour, less than 0·5 gramme of sulphuric acid must be

supplied per second; and a suitable arrangement is all that is required for uniformly distributing so small a quantity of fluid over the surface of the pumice.

Such an arrangement consists of a small arched or curved lead disc or plate B, arranged in the centre of the purifier somewhat above the surface of the pumice filling, and on which drops of the concentrated sulphuric acid are allowed to fall from a height of about 1·5 metres, through a pipe C, by means of a funnel and cock or pin-valve D; these drops being sprayed by their impact on the lead disc B, and uniformly moistening the surface of the pumice—the acid being supplied from a reservoir K, provided with filling and emptying devices L, M. The dilute acid running away at J can either be used for other purposes or concentrated by evaporation in lead pans, and again used in the process.

Burners for Acetylene.—Holliday, T., of Huddersfield. No. 17,469; Aug. 7, 1896.

This invention relates to burners for rich gas (such as acetylene), and consists in the combination with an ordinary union-jet burner of a small injector, the motive force of which is the rich gas to be diluted, and which force draws in air through apertures made for the purpose; the quantity being regulated by the size of the apertures admitting air, or by the difference in size of the gas-jet and the opening opposite to it through which the gas and air are injected by the gas-jet and by the pressure of the gas. The object aimed at is to facilitate the regulation of the supply of gas, and to effect partial discontinuance of supply. This is attained by one and the same means—by a needle or equivalent pointed piece fitting an orifice in the gas-supply pipe. The relative movements of the needle and of its seat, so as to form the valve, are effected in various ways, according to the requirements of the case. For instance, the needle may be formed with a screw part, and be actuated within a certain limited range of movement (determined by stop parts); or the needle may be fixed, and the seating portion of the valve be so moved: or, again, the needle (or the seating parts) may be moved by a cam or eccentric action.

Dry Gas-Meters.—Matyr, E. B. de la, of San Francisco. No. 6883; March 16, 1897.

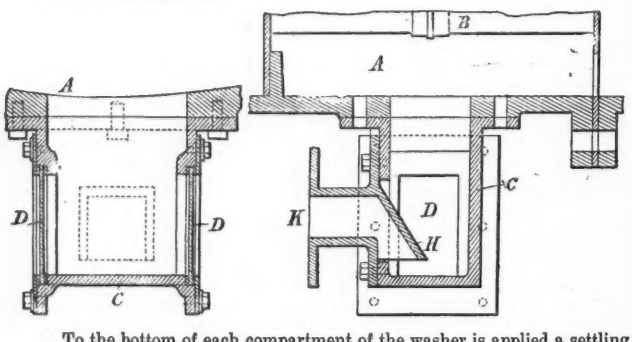
The principal features of novelty in this invention embrace: (1) A revolving measuring drum having a plurality of compartments, each provided with a flexible diaphragm which forms a moveable side wall to the compartment; (2) a valve which is actuated by the turning of the drum, and which operates to bring the compartments at the descending side of the revolving drum successively into communication with the supply-pipe and the compartment at the rising side of the drum successively into communication with the delivery-pipe; (3) means acting on the moveable side walls of the compartments at the rising side of the drum operating to throw the walls inwardly, so as to expel the gas from the compartments—the drum being rotated by the preponderance of weight at its descending side due to the diaphragms being at a greater distance from the axis of the drum than those at the ascending side.

Starting Gas-Engines.—Schütz, C., and Heydemeyer, H., of Oeynhausen, Westphalia. No. 9098; April 9, 1897.

This arrangement for starting power engines consists essentially of revolving mechanism for overcoming the dead-points. It is characterized by the provision upon the main-shaft of the engine of a wheel with diagonally placed teeth, into contact with which can be brought a wheel fixed on a special shaft through the sideways adjustment of the shaft. In this way, by the turning of the special shaft, the main shaft of the engine can be revolved; so that the latter when it revolves, of its own motion, pushes the teeth of the gear wheel sideways, and moves them out of gear. An adjusting fork is provided with a spring bolt, which, upon the disengaging of the gearing by means of the wheel of the power engine, springs into a fixed slot, and thereby fixes the auxiliary shaft, while a pawl falling at the same time into the ratchet-wheel prevents it revolving. The crank-handle serving to revolve the auxiliary shaft is fixed loosely upon the shaft, and engages, by means of the clutch gearing provided with diagonally placed teeth, with the shaft.

Gas-Washing Apparatus.—Holmes, E. D., of Huddersfield. No. 10,268; April 24, 1897.

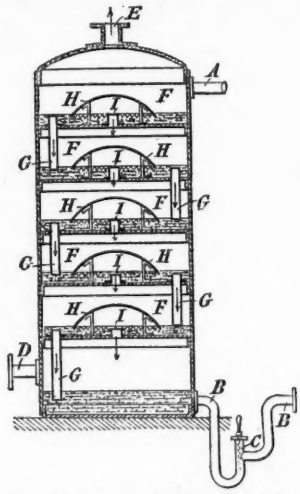
This invention relates to gas-washing apparatus, "whereby the tarry matter and impurities are allowed to settle, and their presence can be ascertained, so that, when they appear to be in such quantity as would interfere with the operation of the apparatus, they can be run off in a more or less concentrated form without requiring much change of the water in the apparatus."



To the bottom of each compartment of the washer is applied a settling or catch vessel, constructed as shown in the illustration (vertical sections or planes at right angles to each other). A is part of the bottom of a compartment of the washing apparatus, which is usually cylindrical; and B is the lower part of one of the revolving brushes or agitators. An opening is made through the bottom of the compartment, and there is fixed to the bottom the settling or catch vessel C, which has glass at its sides D. On the front side of the vessel, there is a deflector H and an outlet, to which is attached a discharge-pipe K, furnished with a valve. While the apparatus is in operation, the tarry and other impurities gradually subside and settle in the vessel C, mixed with more or less water. When the contents are seen to be thick and dark, they can be run off by the pipe K; the deflector H ensuring the issue of the heaviest and thickest layers from the bottom of the vessel.

Removing Carbonic Acid and Hydrogen Sulphide from Ammoniacal Liquor.—Feldmann, A., of Bremen. No. 10,501; April 27, 1897.

The removal of impurities from crude ammoniacal liquor according to the present process is based on the observation that by heating the liquor in distilling columns to a temperature of at least 94° to 97° C., a simultaneous and sufficiently complete removal of carbonic acid and hydrogen sulphide will be effected—probably due to the fact that at this temperature the ammonium carbonate is first dissociated, and that the freed carbonic acid decomposes the ammonium sulphide, with formation of hydrogen sulphide. A further advantage of the process is said to consist in the fact that it is possible to effect at the same time the removal of tarry impurities of the ammoniacal liquor.



The apparatus proposed to be employed consists of a cylinder, in which several compartments F are provided; these being connected with each other by tubes G. Each compartment carries moreover the tube I with the cap H. The liquor enters the column at A, passes through the overflow-pipes G to the large collecting compartment at the bottom, and leaves the column through the syphon tube B, which carries a thermometer at C. Through D a sufficient quantity of steam is admitted into the column, so that the liquor flowing off leaves the apparatus at the temperature named above. The steam or vapour admitted is almost completely condensed in the first compartment above the collecting chamber. In consequence of the heat, the hydrogen sulphide present in the liquor in the form of ammonium sulphide is almost completely removed; while about three-fourths of the carbonic acid present are removed and blown off at E, together with the tarry products.

APPLICATIONS FOR LETTERS PATENT.

15,389.—Healy, P., and Crawford, R., "Gas-heated irons." June 28.
15,411.—Bosch, R., "Gas-engines." June 28.
15,545-6.—Hatton, E., "Improvement in gas lighting apparatus." June 30.
15,554.—Schmitz, W. J., "Gas-cookers." June 30.
15,603.—Delahaye, E., "Gas-engines." June 30.
15,681.—Davy, D., "Gas and other engines." July 1.
15,712.—Baines, W., and Norris, W., "Gas and oil engines." July 1.
15,732.—Allin, S. S., "Regenerative lamps." July 2.
15,754.—Smith, F. H., "Acetylene gas generators." July 2.
15,788.—King, C., "Gas and like taps." July 2.
15,793.—Croft, B., "Overhead incandescence gas-lamps." July 2.
15,804-5.—Perl, J., "Automatic gas igniters." July 2.
15,900.—Soxhlet, E., Van den Berghe, F., and Borreman, A. & V., "An improved lighting and heating gas, and means for producing the same." July 3.

Colchester Corporation Water-Works—At the meeting of the Colchester Town Council last Wednesday, the Water Committee stated that the Auditor had reported that the income from water-rents during the past year had increased by about £100 over the previous twelve months; and the sum of £500 had been contributed in aid of the general district rate. A saving of nearly £200 had been effected in the amount of rates and taxes; and there was a further reduction in the cost of coal. In respect of expenditure, which could probably be classified as capital outlay, amounting to nearly £1000, £494 had been added to the property account, and £500 had been borne by revenue. The working expenses were about 15 per cent. of the rentals; and in a very few years, the loans bearing the higher rate of interest (4 per cent.) would be repaid—resulting in an annual saving of about £250. Alderman Paxman, in moving the adoption of the report, said that altogether £3166 had been added to the water-works property during the year. The Committee were hoping that, within a reasonable period, they would be able to pay off some of the capital; and if this could be done, they would probably be able to borrow at 2½ per cent., and effect a considerable saving. They were making satisfactory progress; and every little while adding to the income. The report was adopted.

CORRESPONDENCE.

[*We are not responsible for the opinions expressed by correspondents.*]

The late Mr. J. Orwell Phillips.

SIR,—As the oldest member of the clerical staff at the chief office of The Gaslight and Coke Company, may I be allowed to add my humble tribute of admiration of, and affection for, the memory of the late Secretary and General Manager? I am sure I am not only expressing my own feelings but those of my colleagues when I say that Mr. Phillips's name and memory will be always held in high esteem by all who were privileged to know and serve him. His largeness of mind, general urbanity, generosity, and kindness, powerfully impressed his subordinates, and acted upon them with a constraining power; and thus his great influence was felt through all departments of this colossal undertaking. Every officer of the Company shared the inspiration of the noble example which Mr. Phillips has left as a glorious legacy to us, and which I am sure we shall all do well in endeavouring to profit by.

RICHARD TUCKER.

The Gaslight and Coke Company,
Horseferry Road, S.W., July 7, 1897.

The Claus Process at Belfast.

SIR,—In Mr. Stelfox's able and most impartial account of the Claus process at Belfast, as presented to The Gas Institute, there are two or three matters on which I may be able to offer some explanation. The two principal points made against the process are the frequent interruption of work and the varying efficiency of the process when at work; and, as Mr. Stelfox confesses his inability to afford any explanation of these defects, it may be as well if I try to make the matter a little clearer.

By far the most serious difficulty we had to deal with was that of leakage of liquor from practically all parts of the plant. I shall not be far wrong in saying that there was not a single part of the plant that did not, at one time or another, cause serious loss and delay by leakage. How far this was due to bad design, and how far to bad construction, it is now hardly worth while to inquire; but most engineers will, I think, admit the possibility of so designing and constructing a plant that leakage will be reduced to an insignificant amount. That this is so is proved by the fact that during the time we were at Belfast we had either to take to pieces and reconstruct, or, where this was impossible, to patch up, nearly every part of the plant through which the liquor passed; and I can assert that every such part of the plant that we reconstructed was perfectly sound from that time, and that from even the patched-up parts leakage was very largely reduced. If a plant can be made fairly sound by patching, it can certainly be made sound in the first place.

On the question of the uncertainty of action of the plant, I am unable to agree with Mr. Stelfox. The table of results quoted in the "JOURNAL" for the 29th ult. (p. 1477) relates to a period when purification was imperfect; and I do not think that conclusions drawn from results obtained under such conditions are applicable to the process when working under those requisite for complete purification. The conditions existing in the scrubbers when the quantities dealt with are within the capacity of the plant, are essentially different from those which obtain when impurity is passing from the system. When the ammonia supplied to the scrubbers is sufficient, or more than sufficient, to combine with the whole of the impurity in the foul gas, there is an accumulation of free ammonia in the middle scrubbers which is available for combination with any temporary increase of impurity. On the other hand, if the impurities are in excess of the ammonia supplied, there is no such available stock, and the amount of impurity at the outlet will vary with that at the inlet, and also with any temporary variation of the ammonia supply.

The table of results shows wide variations in the amounts of impurity, especially of carbonic acid, in the foul gas, and equally wide, or wider, ones in the impurity at the outlet of the scrubbers. But quite as wide variations in the impurity in the foul gas occurred during the periods when purification was complete, and nevertheless the gas remained clean at the outlet. Any interruption of complete purification during these periods was due to some mechanical breakdown which should not have happened.

It is undeniable that there were too many points at which such faults could occur; and if ever this process, or a similar one, is taken up again, success must be looked for in the improvement and simplification of the plant. All my experience has only convinced me more strongly that, if the mechanical difficulties are overcome, the process will be found to work satisfactorily. That they can be overcome, I have little doubt; and, indeed, most of the difficulties met with at Belfast were eventually got over, although the radical defects of the plant, and its insufficient size, were such that it was impossible to obtain a satisfactory result by anything short of complete reconstruction.

CHARLES W. WATTS.

July 4, 1897.

Naphthalene and Carburation.

SIR,—Mr. F. E. Linging, in his letter in your last issue, is evidently confusing the proposals of Messrs. Young and Glover, in their paper read at Bath (*ante*, p. 16), with the process in use at Hastings, which is really now used to retain the naphthalene which is in the gas as it leaves the holders, and so prevent stoppages in the mains and service-pipes, besides enabling the illuminating power to be better maintained at the extreme limits of the district supplied. I am pleased to say that the process is increasingly successful, as the figures appended, referring to the past half-year's working, will show:—

Carburation for the Half Year ended June 30, 1897.

Gas made	189,247,000 cubic feet.
Oil used	1,122 gallons.
Cost of oil used	£28 1s. 0d.
Suspension of oil per 1000 cubic feet of gas made	0·006 gallon.
Cost of oil per 1000 cubic feet of gas made	0·035d.
Number of stoppages of all kinds in service-pipes (of which 50 per cent. were due to water)	254
Average per day	1·40
Ratio to gas made, 1000 cubic feet to	0·0013 stoppages.
" number of consumers, 1 to	0·036 consumers.

Number of Stoppages.

Half year ending June 30, 1893	1688
" " 1894	1796
" " 1895	3955 (*a*)
" " 1896	677 (*b*)
" " 1897	254

(*a*) Very severe weather. (*b*) Carburation had been started.

The paper of Messrs. Young and Glover had been looked forward to as possibly giving us information as to how all the naphthalene could be retained in the gas during the process of manufacture. Unfortunately, it does not add much to the general knowledge on the subject, but elaborates the drastic remedy of taking naphthalene out of the gas to save after-trouble with it in distribution. In the process of manufacture here, we have comparatively little trouble now; and experiments are proceeding which we hope will still further minimize it.

CHAS. E. BOTLEY.

Hastings, July 8, 1897.

SIR,—In writing about this bugbear, Mr. F. E. Linging, in your issue of July 6, quotes two cases of works differently constructed and the results variable as to naphthalene.

I am acquainted with two works using coal from the same source, and obtaining almost equal results therefrom. In both of these, the hydraulic main was about 2 feet above the retort-stack. In one, the gas and tar travelled away together, and then went through vertical, annular condensers. In the other, the tar left the hydraulic main through a separate pipe; and the gas went to a dry main, and then through horizontal condensers. In the first case, choked ascensions and naphthalene were present; in the second, they were absent.

Yet another case. Trouble had been experienced in a works from choked ascensions and naphthalene. To cure the first evil, a long spiral agitator, about 14 inches in diameter, was fitted in the ∩-shaped hydraulic main—resting on the bottom, and touching some of the dip-pipes. By means of a handle, this agitator was made to revolve daily, in order to stir up the thick tar.

It has been frequently asserted that condensation is a host to be reckoned with when naphthalene is hanging round. Hence the question arises, where shall it begin? That there must have been a bath of hot thick tar for the gas to pass through in the hydralic main, seems evident; and choked pipes followed.

Does it not seem likely that, if the gas were kept out of contact with the hot, thick tar, and by means of a separator-valve, which would allow only a shallow depth of liquor, taking the overflowing tar and liquor away at once, this trouble would be eliminated?

T. S. CLEMINSHAW.

July 9, 1897.

The Supply of Welsh Curley Cannel.

SIR,—My attention has been called to a paragraph in the paper read by Mr. Davis at the recent meeting of the Incorporated Gas Institute and given in your issue for the 6th inst. It is there stated that, "previous to June, 1896, the Welsh Curley cannel pits had been worked out and closed, so that no more of it was procurable." Will you allow me to state that, while it is quite true that the seam of Curley which was being worked at the Padeswood Colliery was exhausted early in 1896, my Company were at that time in active operation opening up a new discovery of Curley cannel at Pontybodkin, which is midway between the old Leeswood range and the Padeswood pit. The seam we are working is identical in quality with that worked at Padeswood, but is of much greater extent.

FRANK C. POTTER,
Secretary, Pontybodkin Cannel Colliery Company, Limited.

4, *Great George Street, Westminster, July* 7, 1897.

Gas-Stoves and Coal-Fires.

SIR,—It is now somewhat more than sixty years since I first tasted food cooked by gas. I happened to be present at an accidental meeting of two or three gentlemen engaged in gas matters—then called superintendents, not engineers—when, among other things, it was said by one of the parties that gas might possibly, after a time, be used for cooking purposes. But another said, in reply, "Oh dear, no. It stands to reason that anything cooked by gas must taste and smell of gas." Nevertheless it was decided, after a little discussion, to make a trial of it; and I was instructed to assist in doing so.

To the best of my recollection at the present time, the trial was made in something like a tin saucepan, with the bottom taken off for the purpose. An argand burner with a glass chimney was put inside the saucepan, as close to the outside as possible, and a mutton chop in a similar position on the other side; the two being kept as far apart as could be, to prevent contamination. The chop, as might be expected, took a long time to cook; but when it was done, I offered it first to the gentleman who had spoken against the trial being made, but he refused to have anything to do with it, and then separately to each of the other two, who both declined in the same way. The chop was then left on my hands; and I, after tasting it first, and not finding anything objectionable in the taste, ate the whole of it, and reported that it was as free from the taste or smell of gas as anything could be. But as I happened to be in the employment of one of the parties, I was probably looked upon as a prejudiced witness; and, as far as I know, nothing further was done about it.

Many years after that, I accidentally heard that gas was being somewhat extensively used for cooking purposes in the kitchen of the House of Commons; so I obtained an introduction to the manager of the department, and waited upon him to see what he was doing. He received me very kindly, gave me much information, and said the apparatus he was then using was entirely his own invention. But it is needless to repeat what I then heard and saw. I may, however, add that all the gas-stoves I have seen since appear to be constructed upon much the same principle, though it does not seem to me to be the best that might be adopted for the use of gas. It was, however, many years after that again that the gas companies themselves showed any disposition to adopt the cooking system.

In referring to this matter, it may be necessary to state that I am not practically a gas man. Nevertheless, I have used a gas-stove for several years; and, so far as my other avocations would permit, I have given much attention to gas matters. It has thus often occurred to me that gas companies, while devoting all their powers to the best mode of making and storing gas, have neglected other powers which, had they been carefully attended to from the first, would have been infinitely more beneficial to them now—that is to say, the best method of applying gas to the multitude of purposes for which it might be usefully employed.

Speaking from my own experience, I can say that, a short time since, being under the necessity of using a gas-stove in my house, I found, after a short trial of it, that it was more useful for all general purposes, and more regular, economical, and cleanly for cooking, and that it occupied less time in the different operations, than a coal fire. When cooking with gas, the weight of the joint being known, the heat of the stove can be regulated accordingly, and the time it will occupy in cooking be ascertained with certainty, and relied upon. The joint may be left to itself until finished; no personal attendance being required. But with a coal fire, attendance is necessary during the whole time the cooking is in operation. Gas, it should be remembered, is available at all times. Early or late, by day or night, it can be turned on and put in action at any moment without delay, and turned off again directly it is done with, so that all further expense may be stopped at once; and there is much less risk of casual fires and injury to young children by using gas than in having coal fires. Gas ought therefore, wherever it is practicable, and during warm weather, to be used on all occasions in preference to coal.

Apart from dwelling-houses, there are many thousands of places in the Metropolis alone where coal-fires are used every day for steam-engines and other trading operations, which, under suitable arrangements, might be supplied with gas for heating purposes instead of coal; and if gas companies who have abundant means of making experiments would but give due attention to these matters, there can be no doubt but that it would soon be effected, and the time now occupied in attending to coal fires be given to other and more useful purposes. Personally, I have not the slightest doubt, though it may be presumption on my part to say so, that "the use of gas" is simply in its infancy, and that before any very great length of time it will, as it ought, to a very considerable extent supersede coal fires.

G. A. S.

July 7, 1897.

Boston (Lincs.) Gas Company.—The annual meeting of this Company was held last Thursday. The revenue account showed a profit on the year of £2952; and the statutory dividends were declared on both old and new shares.

The Price of Gas and the Coal Duty at Worthing.—Some years ago the Worthing Town Council raised a loan of £30,000, for the repayment of which a coal duty of 2s. 6d. per ton was levied. As the debt has been cleared off to within £400, the Council have reduced the duty to 6d. per ton. The effect of this decision will be a reduction of 3d. per 1000 cubic feet by the Gas Company, who have only been waiting for the abolition of the duty to make this concession to the consumers.

Robin Hood's Bay Gas Supply.—For many years this little watering-place had a more or less satisfactory gas supply at a charge of 5s. 10d. per 1000 cubic feet; but the Lighting Acts were ultimately abandoned in despair, and darkness has reigned in the streets during the nights of the past two winters. Now, however, with the prospect of an increased consumption and development of building enterprise, a local Syndicate has bought the gas-works, and already considerable alterations are on foot. Extensions of mains and other steps for bringing the works up to date are being arranged; and it is estimated that before long the Company will pay a dividend. It is likely the Lighting Act will again be adopted.

Warrington Corporation Gas Affairs.—The minutes presented by the Gas Committee at last Tuesday's meeting of the Warrington Town Council contained a resolution that the Town Clerk be authorized to apply to the Local Government Board for sanction to the borrowing of £10,000 for the purchase of prepayment and other meters, and of £20,000 for gas-works extension. Mr. Roberts pointed out that it would have been better if the Committee had come before the Council with a scheme of the extensions required; so that the matter might be discussed. He moved that the resolution be withdrawn until the Council were made acquainted with the Committee's proposals. He did not know what the capital expenditure would be; but it seemed they were as far off as ever with regard to electric lighting, which was not exactly the position for a borough of nearly 60,000 inhabitants to be in. Aldermen Harrison and Sutton criticized the resolution in the same strain, and finally the portion of the resolution referring to the £20,000 was withdrawn.

Extensions at the Guildford Gas-Works.—Very extensive additions are now being made to the Guildford Gas-Works; the amount involved by the contracts already accepted being about £25,000. The works have been necessitated by the enormous increase in the demand for gas in the neighbourhood; the sales having risen from 59,622,100 cubic feet in 1886, to 106,782,900 cubic feet in 1897. This increase has put the greatest possible strain on the works; and the general tendency of things points to this rate of increase being maintained, if not accelerated. The Gas Company therefore found themselves face to face with a state of affairs which had to be promptly dealt with. Their Consulting Engineer (Mr. Corbet Woodall, M.Inst.C.E.) was called in; and he produced plans for a large extension and improvement of the present works. Last year the Company obtained parliamentary power to raise the necessary capital; and part of it is already raised. The manufacturing plant is being extended by an installation of carburetted water-gas apparatus by Messrs. Humphreys and Glasgow; the purifying plant is being more than doubled; four new 30 feet square purifiers are being put in, and round them are being built sheds for oxide and lime. The storage capacity of the works is being increased by the addition of a gasholder having a capacity of a million cubic feet, which is being constructed on a 6-feet bed of concrete. It will be 125 feet in diameter; and the tank will be 25 feet high. The holder will have four lifts of 25 feet each; the total height from the ground being about 130 feet. At present the storage capacity of the works is only 430,000 cubic feet; so the addition will more than treble it. Sulphate of ammonia plant is also being added.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills read the first time, and referred to the Examiners: Borrowstounness Water Provisional Order Bill, Duntocher and Dalmuir Water Provisional Order Bill, Kingston-on-Hull Corporation Bill.

Bills read a second time: Dundee Corporation Bill, East London Water Bill, East Warwickshire Water Bill, Local Government Provisional Order (Gas) Bill, New River Company Bill, Southwark and Vauxhall Water Bill, Weymouth Water Bill.

Bills reported: Cirencester Water Bill, Colne Corporation Bill, Llandudno Urban District Council Bill, Local Government Provisional Order (Gas) Bill, Newark Corporation Water Bill, Nottingham Corporation Water Bill.

Bills read the third time and passed: Local Government Provisional Order (Gas) Bill, Rhymney Valley Gas and Water Bill, Tuxford and District Gas Bill.

Petitions have been presented against the East London Water Bill, the New River Company Bill, the Southwark and Vauxhall Water Bill, and the Weymouth Water Bill.

The East London Water Bill, the New River Company Bill, and the Southwark and Vauxhall Water Bill have been referred to a Select Committee, consisting of Lord Wantage (Chairman), the Earl of Portsmouth, the Earl of Powis, the Earl of Beauchamp, and Lord Crofton; to meet on Monday, July 12.

The Weymouth Water Bill has been referred to a Select Committee, consisting of the Duke of Westminster (Chairman), the Earl of Yarborough, Viscount Falkland, Lord Manners, and Lord Clanwilliam; to meet on Tuesday, July 13.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bills read the first time and referred to the Examiners: Gas Orders Confirmation Bill (No. 2), Rhymney Valley Gas and Water Bill.

Bills read a second time and committed: Gas Orders Confirmation Bill (No. 1), Water Orders Confirmation Bill.

Bills reported: Borrowstounness Water Provisional Order Bill, Deal and Walmer Water Bill, Leicester Corporation Bi l, Manchester Corporation Bill, Salford Corporation Bill.

Bills read the third time and passed: Borrowstounness Water Provisional Order Bill, Duntocher and Dalmuir Water Provisional Order Bill, Eastbourne Water Bill, Hunstanton Water and Gas Bill, Kingston-upon-Hull Corporation Bill, New Hunstanton Water and Gas Bill.

HOUSE OF COMMONS COMMITTEE.

Thursday, June 3.

(*Before Mr.* Rankin, *Chairman, Mr.* Reckitt, *Mr.* S. Smith, *and Mr.* Newdigate.)

SOUTHWARK AND VAUXHALL WATER BILL.

This Bill, to enable the Southwark and Vauxhall Water Company to increase the quantity of water they may take from the River Thames, came before the above-named Committee to-day.

Mr. S. Pope, Q.C., Mr. Claude Baggallay, Q.C., and Mr. Du Cane appeared for the promoters. The other Counsel engaged were: Lord R. Cecil and Mr. S. Matthew, for the Middlesex County Council; Mr. Balfour Browne, Q.C., Mr. Worsley Taylor, Q.C., and Mr. Freeman, Q.C., for the London County Council; Mr. Freeman, Q.C., and Mr. C. C. Hutchinson, for the Corporation of Kingston-upon-Thames and other Local Authorities; Mr. J. C. Earle, for the Vestry of St. Mary, Battersea; Mr. R. D. M. Littler, Q.C., C.B., and Mr. Rigg, for the Corporation of London; and Mr. Pember, Q.C., and Mr. Rickards, for the West Middlesex Water Company. Appearances were also reserved on behalf of the Grand Junction and Lambeth Water Companies.

Mr. Pope, in opening, said this was a Bill to enable the Southwark and Vauxhall Water Company to take from the River Thames a further supply of water—in fact, to take as much as they required, as much as they had been in the habit of taking—for the purpose of supplying their district. By the Southwark and Vauxhall Water Act of 1884, the Company's limits of supply were extended; and by an agreement made in December, 1886, it was agreed between the Conservators and the Company that the latter might take in any 24 hours a quantity of water not exceeding 24½ million gallons. In 1894, the Company's limits of supply were further extended; and to meet their needs, the Company, as a matter of fact, during recent years had frequently taken more than the 24½ million gallons daily from the river—their consumption being nearer 40 million gallons a day than the lower figure. They had always held that their powers enabled them to take, either through the gravel-beds adjoining the river or from the river itself, the difference between the quantity stated in the agreement with the Conservators and that which they actually needed. The Royal Commission had considered the question; and they reported that physically it must be taken that the water abstracted through the gravel-beds was water which originated in the Thames, and therefore ought to be considered as a supply drawn from the Thames. In January last, the Conservators, by means of their agreement with the Company, obtained an injunction from the Law Courts restraining them from taking more than the 24½ million gallons daily. The Company then sought advice, and at last decided to promote a Bill, and place their position before Parliament. In the Bill as originally deposited, the Company made a proposition which they thought was harmless; but it met with opposition. The emergency was so great, and so immediate, that they did not think it right to fight at any great length questions of the quantity, the time, or the terms on which the supply should be granted. They merely proposed therefore, entirely with the consent of the Conservancy, that the Company should

be enabled to take for one year whatever water they required; the intention being to come next year for power to construct reservoirs to equalize the demand upon the river, and thus avoid drawing upon it at unfavourable times. This would be in accordance with the recommendations of the Royal Commission, and would be complying with the wishes of the Conservancy Board. The Bill was designed purely to meet the present pressing need; and it would leave it open to anyone who might have any objection of any description to make to come next year and press it. It threw on the Company an absolute obligation to bring forward another Bill for the construction of reservoirs next year. If it was passed, the permanent water supply was to be regulated solely by next year's Bill; and if next year's Bill were not passed, the present Bill would expire in two years' time. In conclusion, Counsel dealt briefly with the petitions.

Sir *F. Dixon Hartland*, M.P., Chairman of the Board of the Thames Conservancy, in reply to Mr. BAGGALLAY, said he was well acquainted with the arrangements by which all the Companies drew water from the Thames. The Southwark and Vauxhall Company had their intake at Hampton. The present Bill was due to the obtaining by the Conservators of an injunction; and the injunction had been suspended to allow it to come before Parliament. The effect of existing agreements, was that the Company could only take 24½ million gallons a day from the Thames; and the Conservancy maintained that the Company had no business to have wells near the river. Owing to various Acts that had been passed, it was not possible for the Conservancy to agree to allow the 24½ million gallons in a particular day to be increased. As first deposited, the Bill did not comply in one particular with the agreement that had been come to between the Company and the Conservators; but now it was absolutely agreed. The effect of the Bill was intended to be that, while fixing the rates of payment for the water taken, and that the quantity should be increased to 45 million gallons a day all other questions should be left open for discussion next year. He had satisfied himself that the increased powers sought were absolutely necessary for the supply of the district.

Cross-examined by Mr. LITTLER: The present was a purely temporary arrangement, and without prejudice to anyone's rights hereafter.

Mr. PEMBER: While you were about it, instead of letting your injunction stand over for this temporary measure, why did you not agree to let it stand over till next year, when you could come for an effective scheme?

Witness: The Judge suggested this.

As a matter of fact, you can agree that they can take 45 million gallons a day?—No; because the Act of Parliament will not allow us to do that.

But you are doing it?—Yes.

If you can hold your hand from 1894 to 1897, you can just as easily hold it till 1898?—That is only hypothetical.

The CHAIRMAN: The injunction was not obtained in 1894.

Mr. PEMBER (to witness): You need not have gone for an injunction. The thing could be done by letting the injunction stand over.

By Mr. BALFOUR BROWNE: There was nothing illegal in letting the injunction stand over till next year; they applied for it because they wanted to bring the Company to book. The Company had been drawing the excess quantity, and not paying the Conservators for it. Under the present Bill, they would pay for it. As at present arranged, the injunction stood over till January, 1898. As to the suggestion that it should be further suspended till July, 1898, to give time to bring in the perfected scheme, he said the present arrangement was the Judge's suggestion; and it was not for the Conservancy Board to interfere. The price to be paid the Board was £191 per million gallons for all they took in excess of their legitimate quantity; and the excess quantity the Bill empowered them to take was 20 million gallons.

Mr. BALFOUR BROWNE: Do you know, as a fact, that the Southwark and Vauxhall Company pump and supply water at the rate of 41·75 gallons per head?

Witness: No.

Do you know that the Kent Company supply at the rate of 29·74 gallons per head?—No.

Does that not indicate that they are not looking after their pipes?—No.

Do you know that one of the Engineers said it was cheaper to pump water to waste than to repair leakages?—No.

By Mr. FREEMAN: The present statutory powers of the Company to take water were 24½ million gallons a day.

Mr. FREEMAN: Were you quite right that the alteration which this Bill makes will be only to entitle them to 20½ million gallons more? Is that your impression of what the Bill is?

Witness: The Bill is, as I understand, to take the extra quantity which will be required for their needs for one year.

Is it your impression that all they would for this year have the right to do would be to take 45 million gallons in any day?—My impression is that they will not take anything like the amount. I understood the Bill to mean that Parliament would give them leave to draw what was absolutely necessary during that period.

At any time, so long as there are 300 million gallons passing over the Penton Hook Weir, the Company may, in any day, make up arrears of any quantity which they draw in any preceding day, less than the 45 million gallons, providing that the total in the half year does not exceed the aggregate for all the days of the half year of 45 million gallons?—As long as 300 million gallons go over Penton Hook, it does not matter to us what they take. If the Company had been drawing only 20 million gallons for several days, and on one day there were 300 million gallons flowing over the weir, on that day the Company could, if their pipes would carry it, make up the arrears of those days. The greatest amount drawn on one day, he believed, was a little over 40 million gallons.

Cross-examined by Lord R. CECIL: The injunction was, by arrangement, suspended till the beginning of next year.

Lord R. CECIL: What will happen then, if Parliament does not give them this relief?

Witness: I do not know. Nearly half their district will have no water at all.

Do you mean to say you will enforce your injunction?—Certainly; we have no right to allow them to do it; and the Judges have said we are not to allow them to do it for more than twelve months. If Parliament does not pass this Bill, they must face the question of a water famine.

But supposing you do not enforce the injunction, nothing will happen?—But we are bound to enforce it.

No; you can do exactly as you like about it?—If Parliament will not give them power to take the water, we shall enforce it.

Then it will not be Parliament which induces the water famine, but you. Supposing nobody enforces the injunction, nobody will be injured at all?—If we do not enforce the injunction, we are in this position: That they are not obliged to bring in their new scheme to get reservoirs, and do everything which we think an absolute necessity for the navigation of the Thames.

Re-examined by Mr. BAGGALLAY: The Company claimed unrestricted powers under an old Act as to taking water; and the Conservators held that the subsequent agreement was binding. The Court decided in favour of the latter contention. There was no collusion between the two bodies; and the case was fought hard. The price of £191 for every million gallons taken on an average per diem, was calculated on the basis of what was paid under existing statutes for the present quantity of water which the Company took. It was really £191 per 365 million gallons. The money paid to the Conservators was to cover the expense they were put to in carrying out works for the purification and preservation of the flow of water, of which the Companies would get the advantage. The works of the Company were such that water to last for only a very short time could be stored; so that the Company on any particular day could take only very little in excess of the 45 million gallons.

Sir *H. E. Knight*, in reply to Mr. DU CANE, said he was Chairman of the Southwark and Vauxhall Water Company. By the Act which united the Southwark Company and the Vauxhall Company, they were allowed to draw without limit from the Thames. An agreement was subsequently entered into with the Conservators, under which the Company were to make a yearly payment of £300 to the Conservators, and to draw only 20 million gallons a day. In 1886, a second agreement was entered into, by which the Company were, in consideration of a larger payment, allowed to take 24½ million gallons a day. The present payments of the Company to the Conservancy totalled to £4678 a year. The Company's requirements increased in consequence of the growth of the population; and the Company took water to supply them in excess of the 24½ million gallons—being under the firm belief that they were right in doing so. After the injunction was obtained, the Company applied to all the other Water Companies, but found, as they already knew, that none could possibly assist them, as they wanted all their authorized supply for their own purposes. They were therefore compelled to make the present application; an agreement having been come to with the Conservancy. The price to be paid per million gallons varied at different stages of the 20 millions in question; the object being that the Company should not take more than was absolutely required. Part of the agreement was that the Company should apply to Parliament next year for powers to construct reservoirs, and that the Act should be restricted to a period, originally of eight years, but now of two years.

Mr. DU CANE: If you get powers next year to construct reservoirs, and so forth, this Act will no longer be in force, will it?

Witness: I understand that is the intention of the Act as now amended. It was absolutely necessary, in the interest of the consumers, that the Company should have power to take the excess quantity of water; their district having increased very much. In 1876, the population supplied was 504,406; in 1896, it was 891,213. In 1876, the number of houses was 77,680; and in 1896, 119,948. In 1876, the number of gallons per head per day was 37·6; in 1896, it was about 38·39. To understand the last figures, it was necessary to have those for intervening years, because they varied very much, as the year was wet or dry. The figures were: 37·68 in 1876; 33·31 in 1881; 28·64 in 1886; 31·2 in 1891; 33·1 in 1892; 35·4 in 1893; 36·4 in 1894; 40·9 in 1895; and 38·3 in 1896. The total daily average quantity supplied in 1876 was 18,900,000 gallons; in 1881, 23,262,000 gallons; in 1886, 22,600,000 gallons; in 1891, 26,281,000 gallons; in 1892, 28,178,000 gallons; in 1893, 30,486,000 gallons; in 1894, 31,616,000 gallons; in 1895, 35,947,000 gallons; and in 1896, 34,050,000 gallons. The figures were apt to be misleading, because the Company had to provide for the maximum demand. The largest daily supply in 1895 from the Thames was 40,063,153 gallons; in 1895 the largest quantity taken in any one day was 41,457,560 gallons, which was also the largest quantity ever taken. Besides this, they had the water from the Streatham well. Roundly speaking, the quantity pumped daily was 38 million gallons.

Mr. BALFOUR BROWNE (in cross-examination): Supposing your consumers can get as good water at cheaper rates elsewhere, why should they have your supply in preference to the other?

Witness: Certainly, on commercial principles I should go where I could get the best article at the lowest price. There is a portion of the Company's district in which, if the Company did not supply, the West Middlesex Company could do so.

Are you aware that if I happened to be a person living in that district, and you gave up supplying, and I took it from the West Middlesex Company, I would get the water 20 per cent. cheaper than from the Southwark and Vauxhall Company?—Certainly not; nothing of the sort.

There is another portion of the district which could also be supplied by the Kent Water Company. Supposing you gave up all that is in the West Middlesex, and all that is in the Kent Company's district, do you mean to say that 24 million gallons a day, which you are by law allowed to take from the Thames, would not do what you want?—What you suggest is an impossibility. The whole of the district is piped by our mains, and supplied by us. Moreover, neither of the other Companies has any water to spare.

Do you know that the Conservancy have no right to sell water at all?—Under the Act of 1894, I believe it was stated by Sir F. D. Hartland very correctly that they have no power to sell water, and we have no power to buy.

And yet, though they have no power to sell and you have no power to take, this Bill will authorize the sale of water by them to you for £191 per million gallons?—Because Parliament said that, if we wanted more water, we were to come to Parliament for it, and we have done so. If the Bill is not granted, the Conservancy Board will enforce the injunction; and the Company would be reduced to the 24½ million gallons.

And you will then be unable to supply a great portion of your district?—If Parliament puts us in that position. I should not let the people die of thirst; I should go on taking the water.

What harm would it do anybody except the Conservancy, if you took the water from the Thames without paying for it?—It would not be a right and proper thing to do, after the decision of the Law Courts. The extra quantity would cost £3800 a year.

The CHAIRMAN: In your opinion, would it be possible for you to go on drawing the extra quantity of water if the Thames Conservancy did not allow it?

Witness: I do not think it would be possible; we might be stopped at any moment.

Mr. BALFOUR BROWNE: Supposing you were stopped, what would you do?

Witness: We could do nothing; we could take no more water.

And people would have to go to the West Middlesex Company?—No.

Mr. BAGGALLAY said all the West Middlesex mains were on the north of the Thames. Even if the Company had mains in the south district, they had not sufficient water to supply them. They would have to come to Parliament for power to take more water from the Thames, just as the Southwark and Vauxhall Company were doing.

Witness (continuing) said it was not true that the West Middlesex prices were 25 or 20 per cent. lower than his Company's.

Mr. RICKARDS said Mr. Balfour Browne had suggested that, by way of reducing the demand on the Southwark and Vauxhall Company, the West Middlesex Company, for whom he appeared, should supply in a locality south of the Thames that was common to both. As to this he had to say, first, that the West Middlesex Company objected altogether to supplying south of the Thames; and next, under the West Middlesex Act of 1852, the Company were not bound to supply any part of their district which was supplied by another Company.

Mr. BALFOUR BROWNE said he was informed that the West Middlesex Company could supply in the district at once, if the Southwark and Vauxhall Company would provide the mains.

Mr. RICKARDS (continuing) stated that, on the understanding that this Bill was to be in force for only one year, and also that its passing would in no way prejudice the discussion of the whole question in 1898, he was instructed to withdraw the opposition of the West Middlesex Water Company.

Cross-examined by Mr. FREEMAN: A 42-inch main passed from the works of the Company through Hampton, Hampton Wick, Kingston, and Malden to London. He was not aware that for years past there had been constant complaints by the local authorities that the mains of the Company were leaking. There had been complaints as regards one pipe. For a very short distance in the neighbourhood of Kingston, the Company had had a great many complaints from the authorities as to the leakage of the 42-inch main. The Company were asked to meet at a conference of local authorities on the matter; but they declined, because it would have been utterly useless. The pipe was now in proper order.

By Mr. EARLE: The Southwark and Vauxhall Company's maximum charge for water supplied in Battersea was at the rate of 5 per cent., and the West Middlesex maximum charge was 4 per cent., on the rateable value. But 81 per cent. of the houses in the district were rated at £30 a year, in which case the Southwark and Vauxhall Company made no extra charge for water-closets, baths, or high services. The Southwark and Vauxhall charge would therefore be about £1 10s., against the West Middlesex £1 4s. But the West Middlesex Company might charge 4s. for each of the three other services he had mentioned; so that their charge might come to £1 16s., against the Southwark and Vauxhall Company's £1 10s.

Mr. EARLE: Have the West Middlesex Company mains passing through Putney, within two miles of Battersea?

Witness: I cannot tell you; but if they have the mains, they have no water to supply.

Have you been informed, on behalf of the Battersea Vestry, that the water you supply has been condemned as unfit for human use?—Yes; we had one or two samples, and they wrote once or twice to the Local Government Board. But it was found their complaints were utterly unfounded. Possibly the Public Analyst for the district condemned the water; but Dr. Frankland and the authorized Examiners approved of it, and said it was the best supplied.

Re-examined by Mr. BAGGALLAY: The West Middlesex Company never had supplied water in Battersea, and had no mains there that he knew of. There were provisions in the Act of 1852, to the effect that where the limits overlapped, one Company should not be under any obligation to supply even the overlapped area, as long as that area was supplied by the other Company. This was certainly so in the case of the Southwark and Vauxhall Company. Battersea was at the present moment supplied by his Company. If the Bill were refused, the Company would still be supplying Battersea, only they would give an inadequate quantity of water. The West Middlesex Company would be under no obligation to supply Battersea. That Company's charges were in some respects lower than those of the Southwark and Vauxhall Company; but if they had to extend their mains into and supply Battersea, that would probably much alter the price at which they could afford to supply water. The West Middlesex Company were pumping at times 23½ million gallons a day; and it was because their limit was 24½ million gallons that they came last year to obtain a further supply under the Staines Reservoirs scheme. This water was solely for their own district. If they were to supply the portion of the Southwark and Vauxhall Company's district which was also in theirs, it would mean furnishing water to an extra population of between 250,000 and 300,000.

Mr. BAGGALLAY: It has been suggested that this is only really a Bill to provide payment to the Conservators; and it is said that without this Bill, you may meet the Conservators without making a payment to them?

Witness: We could not.

Are you subject to Government audit?—Most assuredly we are.

And such a payment, unless it was authorized by statute, would not pass?—I would not make such a payment.

Friday, June 4.

Sir *H. E. Knight*, in response to a request which the Chairman had made the previous day, stated that the rateable value of the Company's district in 1876 was £1,621,640. In the twenty years to 1896, houses of a rateable value of £891,352 had been erected—making the total now £2,512,992. According to the assessment books, however, the total in 1896 was given as £2,783,480. The amount the Company themselves paid in 1876 for rates was £7792; and in 1896, £25,737.

Mr. *James W. Restler*, the Engineer to the Company, examined by Mr. BAGGALLAY, said since 1886 it had been necessary for the Company, in order to fulfil their obligations, to abstract more than 24½ million gallons of water per day from the river. On individual days, they had been obliged to take more than 41 million gallons, notwithstanding that they had a supplemental well at Streatham, which at times yielded rather over 2 million gallons daily.

Mr. BAGGALLAY: If you were to be limited to the 24½ million gallons which you are legally empowered at the present moment to take from the Thames would it necessitate your giving a short supply all over your district?

Witness: Yes; and in some portions it will mean an entire cessation of the supply. The portions first affected would be the high levels—portions of Wimbledon, Battersea, and Clapham Common.

Under these circumstances is it, in view of the injunction which has been obtained and only temporarily suspended, absolutely necessary that you should have further authority to take water from the Thames temporarily?—I think so.

Pending the future of the Company with regard to their Thames supply being settled under the Bill which the Company have undertaken to introduce next year?—So I understand. The payment to the Thames Conservancy under the Bill provides for increasing quantities, taken on an average up to 45 million gallons a day. But in the immediate future I do not anticipate the Company will require anything like this quantity, though on individual days they would require more.

Has the clause which deals with the quantity which, as between the Conservancy and the Company, the Company may take, been settled as a permanent basis of payment?—Yes.

But the quantities allowed to be taken are intended to be thrown open to review by Parliament next year, and also to criticism by public bodies and other Water Companies?—Oh, yes. There are various points which must be dealt with next year. The Thames Conservancy were anxious that the minimum flow should be regulated as in the Staines Reservoirs Act of last year, by taking the flow over Penton Hook Weir—and, pending the construction of Penton Hook Weir, over Bell Weir.

Witness, in further examination, said that, with regard to the petition of Kingston, if the Bill were passed, there would be no greater interference or pressure in connection with the roads of Kingston than at present. The whole effect of the increased powers of taking water would be thrown upon the mains of the Company between the Thames and the reservoirs, unless the quantity delivered to the district exceeded 41 million gallons a day, which was very unlikely, except in the event of the recurrence of recent periods of unprecedented drought and frost. The Company had offered to let the local authority take over the repair of the surface of the roads, when it was necessary for them to be opened in connection with the pipes; the Company paying for the work at the maximum rate charged by metropolitan authorities. The local authority, however, asked for 500 per cent. in excess of this sum; and the Company, of course, objected to pay it.

Cross-examined by Mr. FREEMAN: The Company had a 42-inch main passing through Hampton, Hampton Wick, Kingston, Maldon, and Merton. It was of a total length of about 7 miles; and it had joints about every 12 feet.

Mr. BAGGALLAY interposed at this point with a suggestion that this was not relevant to the Bill.

The CHAIRMAN allowed the cross-examination to be continued.

Mr. FREEMAN said the condition of this main had been a great public grievance for some years past; and it was a matter upon which the whole district he represented felt very strongly. This was the first and only opportunity they had had of bringing the matter before Parliament; and, unless prevented, he should go into it at length. His position was that the main had not been kept in fair and reasonable condition by the Company; and that it caused great damage to his districts, by reason of the Company allowing all the joints to leak. This not only wasted an immense amount of water, but flooded the land and caused great inconvenience while the leak was being stopped. He should therefore ask for the insertion of adequate protective clauses.

Mr. BALFOUR BROWNE said this was part of his case as well; his contention being that, but for this enormous leakage, there would be no necessity for the Bill at all.

Mr. MATTHEW intimated that the same point formed part of his case also.

Further cross-examined by Mr. FREEMAN: He could not say that the average number of openings which the Company had had to make in recent years to repair this main had been 100 per mile.

Mr. FREEMAN: Taking the case of Kingston, from August, 1893, to May, 1897—three years and nine months—do you know that, in a distance of 1½ miles of this main, no less than 197 openings were made, which is at the rate of 112 per mile?

Witness: Yes; it is very possible. I would not say that it has not been so; but it does not follow that they are all leakages.

Is it not a fact that, where these openings have been made, you have put muffs or collars round the joints?—With this main, there are a great many difficulties. It was of unprecedented size in connection with Metropolitan Companies; and in the Kingston district, it lay practically in running sand. When first laid, for eighteen months there were no leakages whatever. Up to the present time, with one exception, the Company has never had a pipe burst through pressure. It was owing to the sand that the pipe sank slightly, and so came to leak a little. In the adjoining district, there had practically never been a leakage, the reason being that the main was in the clay.

I put it to you that in the great bulk of the district the ground is hard clay or very best gravel?—I have never seen it; and I have seen nearly every leakage.

Witness was then cross-examined with regard to the openings at other districts; but he said he could not tell how many there were. When an opening was made, its dimensions generally were 12 feet long, 9 feet wide, and from 7 to 10 feet deep. He would accept it that in 1896 in Kingston there were 63 of these large openings made, for the purpose of repairing the pipes. It was idle to suggest that the quantity of water wasted by the leakages was material.

Mr. FREEMAN: It is a fact that you have pumped in your district an enormous quantity of water to waste?

Witness: No. In common with all the Metropolitan Water Companies, we are hampered with some very stringent regulations, so that we have not the control of the fittings that would be desirable. The

leakages were very often so small that for weeks the water did not get to the surface. Thus, when the ground came to be opened, it was found to be soaked with water. The leakages could frequently be stopped with a knife.

Witness was then cross-examined at some length as to correspondence and communications which had passed between the Company and the local authorities; the latter complaining of the way in which the repairs were effected, and of the number necessary, and the Company maintaining that they were fulfilling all their obligations. It was absurd, he held, to suggest that the Company, instead of doing all these small repairs, should go over the whole main and put it in thorough order. It would be quite unnecessary expenditure. The Company, it was true, declined to meet the local authorities to discuss the matter. The Company were under statutory obligations with regard to the pipe, and could not depart from them. They had always carried out their obligations.

By Mr. BALFOUR BROWNE: The pipe was exceptionally large, but not larger than those used in Manchester, Glasgow, and other places. So far as he knew, there was no Company in the Metropolis that did more to keep down waste. Whenever they sought further powers in this direction, they were opposed and thwarted by the local authorities. The consumption per head in the Company's district had increased in the last few years; but this was due to breaks in consumers' pipes after frost, and not to leakages in the Company's mains. He had put a statement before the Royal Commission, to the effect that it appeared that the future requirements of the district would be not exceeding 18½ gallons per head per day for domestic purposes, and not more than 6 gallons per head per day for trade purposes.

Mr. BALFOUR BROWNE: If you were able to reduce your consumption to that, you would have use for only 20 million gallons per day?

Witness: Possibly. At the time the estimate was made, everything tended to show that the demand would fall as indicated. We had not then the experience of the drought of 1894 or the frost of 1895. Further, with the extension of constant supply, consumption has increased.

What is your rate of filtration?—We are filtering now rather under 2 gallons per square foot; and the area of our filters is about 20 acres, of which about 18 acres are worked at a time.

It is shown on the tables of Sir Henry Knight, that you have taken 43 million gallons on one particular day. I suggest to you that, with your filters, you could not possibly filter the water?—No; and we do not want to. Two million gallons came from the well.

Leaving out the 2 million gallons, you could not filter the remainder efficiently?—I did not say we did filter it. Witness added that the total storage capacity of the Company was about 130 million gallons of unfiltered water, and some 19 million gallons of filtered water—a supply which would only last for a few days at the present rate of consumption. There would soon be further storage available.

Mr. BALFOUR BROWNE, at this point, said he observed the Committee were conferring. He ventured to suggest that perhaps they were looking to the future.

The CHAIRMAN said, to be quite honest, they were thinking of stopping this part of the Bill—this line of argument.

The room was then cleared. On the re-admission of the public,

The CHAIRMAN said: The Committee are of opinion that the Company could not possibly carry out the demands of the petitioners in one year, which is the time this Bill would have to run, even if they, the petitioners, were able to substantiate their claims—upon which point the Committee give no opinion. Therefore the Committee consider it inexpedient to further consider these petitions; and as the matter is one of great urgency, they grant the preamble of the Bill to be proved, with the condition that both the mode of taking the water from the River Thames and the quantity to be taken are to be treated as open questions in next year's Bill. They would suggest that it would be more convenient for the petitioners to raise their various issues upon next year's Bill, instead of now.

Mr. BALFOUR BROWNE remarked that he did not like to say anything that might appear like a criticism upon the decision; but, with great respect, he asserted that the Committee could not pass the Bill until they had heard the opponents. He had a preamble opposition to the Bill. Of course, he bowed to the decision; but he objected to the preamble, and had a large amount of evidence against it.

The CHAIRMAN: The Committee have arrived at the decision that, having heard what they have, they do not consider it expedient to consider these petitions further.

Mr. BALFOUR BROWNE said he had intended to raise the point that the preamble was not proved, and that there was no necessity for the Bill at all. Were the Committee going to preclude him from raising that by evidence and argument?

The CHAIRMAN: That is the decision of the Committee.

Mr. FREEMAN also entered a protest, quite formally, against the Committee's proceedings.

Lord CECIL: Do I understand the decision of the Committee to be that we are not to proceed with the question of the Hampton Wick Road at all?

The CHAIRMAN: Yes; the decision of the Committee is that the petitioners need not proceed with their cases.

Lord CECIL: On no point at all?

The CHAIRMAN: Yes.

Mr. EARLE then made application that the Battersea Vestry should be allowed the costs of their opposition; but this was not granted.

The clauses of the Bill having been gone through—only amendments of minor importance being made—the inquiry closed.

The Committee subsequently reported to the House that a report of the Local Government Board had been considered by them; but they had not thought it necessary to adopt the suggestions of the Board—the Bill, as amended by the Committee, being of a strictly temporary character.

Suggested Purchase of the Yeovil Gas-Works.—At a meeting of the Yeovil Town Council yesterday week, a Committee was appointed to consider and report on the advisability of purchasing the gas-works. An offer was submitted by the Gas Company to fix incandescent burners to the 150 lamps in the town which are not provided with them at present, and to reduce the cost so as not to exceed the present charge for lighting. The offer was accepted with thanks.

LEGAL INTELLIGENCE.

HIGH COURT OF JUSTICE—OFFICIAL REFEREE'S COURT.

Plymouth—Saturday, July 3.

(*Before Mr.* E. POLLOCK.)

The Alleged Nuisance at the Plymouth Gas-Works.

At the conclusion of the expert evidence, as reported last week (see *ante*, p. 47), the following witnesses were called on behalf of the plaintiff:

Mr. *W. T. Bone*, examined by Mr. GRAHAM, said he was a builder, and lived about 300 yards from the end of the new retort-house at the gas-works. Before the retort-house was built, he experienced little nuisance; but afterwards, the whole of his workshop was continually buried by soot and fine gritty ash. Since the alterations were carried out at the gas-works, there had been an improvement in the day-time; but taking day and night together, he got as much dust in his workshop as before.

The OFFICIAL REFEREE: Then it is better by day, and worse by night?

Witness: Yes; that is so.

Examination continued: He had to cover up the material in his workshop, because of the dust. He had complaints at home, and from his tenants, of the fall of blacks on washing-day. If the nuisance continued, he would have to paint his houses more frequently. The putty gave way between the woodwork and the glass, which he attributed in some way to the nuisance. He noticed on certain dates dense volumes of smoke from the chimneys of the gas-works, sometimes accompanied by flame.

Mr. CHANNELL: Have you ever thought it worth while to complain to the Gas Company?

Witness: No.

And you own a considerable number of houses in the vicinity of the retort-house?—Yes.

How do you account for the smoke being as much now as before, and the larger quantity at night than by day?—My idea is that the works are so carried on and managed by day, that the smoke and dirt are kept within the walls of the retort-house (all that possibly can be kept there), and at night it is let loose.

Mr. *Frederick Prout*, examined by Mr. GRAHAM, said he owned about thirty houses in the neighbourhood of the gas-works. After the building of the new retort-house, he experienced considerable nuisance. It was better now than at first. But it was still very bad, especially at night, and when there was heavy wind and rain.

By Mr. CHANNELL: None of his houses was unoccupied. There were other works in the neighbourhood, but none so close to him as the gas-works.

Re-examined: These works were there when he began building in the neighbourhood; and there was no nuisance then.

Samuel Finch, millwright, examined by Mr. GRAHAM, said he had lived near the gas-works for ten years. Since the retort-house was built, there had been a great deal of dirt and smuts. A large quantity collected in the gutters. On May 21 and June 7, his daughter had to take in the clothes which were hung out to dry, and wash them again. She had had to do this scores of times since the retort-house was built. On June 7, the wind was north-east. It was blowing from the gas-works partly over his house.

William Williams, shoemaker, living in the same locality, gave similar evidence.

Mr. *G. D. Bellamy*, M.Inst.C.E., examined by Mr. GRAHAM, said he first visited the tannery on Dec. 18, 1895, when there was a large quantity of smuts and gritty dust about, and the hides were spotted with the same material, which was particularly prominent at the side nearest the gas-works. It was impossible for the state of affairs to have been produced by dust being scattered about.

The OFFICIAL REFEREE: I do not understand anything of the kind to have been suggested, as regards December, 1895.

Mr. CHANNELL: I do not suggest that the general dust in the building was produced by that means.

Witness (continuing) said that he visited the works again on April 29 last. There was then dust of the same character about the place. It was not such as would be produced by dust from an ordinary chimney.

Mr. CHANNELL remarked that the Official Referee visited the tannery on May 7, and saw the state of things then existing; and witness's evidence was therefore a waste of time.

Witness, further examined, said he inspected the corrugated iron roof over the coke-shed, and saw interstices in it through which dust came. He did not think that the direction of the wind had much to do with the prevalence of the nuisance. There was always so much dust in the air in the vicinity of the gas-works, that, unless the wind blew strongly from the north, there would be deposit. There was always an eddy wind under the lee of any structure; and the proximity of the gasholders would have the effect of causing eddies in the vicinity of the works. About 500 feet from the tannery, there was a fellmonger's yard. They had a boiler and steam-engine; but it would have no effect in carrying the nuisance. The Corporation stone-breaking yard was a little farther away. There was a portable steam-engine there for stone-breaking. A steam joinery works had engines and boilers, and a chimney-stack. There was no dust from this building; but there was the usual smoke from the boilers. A starch and blue manufactory had engines and boilers, and so had a candle manufactory; and there were engines and boilers in the saw-mills. He should think that these places were too far off to affect Mr. Ward's premises. Other works were another saw-mills, a tar distillery, and some chemical works. The nearest of the latter was 500 feet away. None of them could cause nuisance in plaintiff's works. They had all been in existence for a long time before the retort-house was built. There were works in the vicinity of Mr. Taylor's works.

Cross-examined by Mr. CHANNELL: The interstices in the corrugated iron structure at the coke-store were in the side, and not the roof. They were at most of the joints that he could see—a score at least—and at about the level of the louvres of the glue-loft, through which he saw them.

By the OFFICIAL REFEREE: His reference was to defects in the overlapping of the sheets at the horizontal joints.

Monday, July 5.

George Adams, recalled and examined by Mr. GRAHAM, said he had been in plaintiff's employ for 19 years, and had charge of the rolling-loft at the tannery. He had kept a diary from the outset of the trouble. Since the end of September, 1896, when the roofing of the coke-shed was completed, the nuisance had been less than before in calm weather; but on a rough day, it was worse. On Oct. 29 last, he entered in his diary that the wind was south-east; and there were blacks in both lofts. He had to stop the machinery in the forenoon. Blacks covered the weather boards, which were being painted at the time; and the gutters were filled with grit, some of which he took out. On Oct. 30, the wind was south-east, blowing very hard; and the blacks were very bad indeed—as bad as ever he had seen them. Machinery was stopped all day. The wind was again south-east on Nov. 4; and the blacks were so bad that the machinery had again to be stopped in the afternoon, as blacks were being rolled into the butts by thousands. They floated on the top of the pits all over the yard. He thought the dust was a little finer since the completion of the roof of the coke-shed.

The OFFICIAL REFEREE: I see that on Oct. 31, and Nov. 1 and 2, when he says the wind was north-east, "the blacks in both lofts are about the same" as when the wind was south-east.

Mr. CHANNELL: The fact is that the official record for all these days is that the wind was north-east.

Mr. GRAHAM: On several occasions you found the same trouble with the wind north-east as when it was south-east?

Witness: Yes; my explanation is that when the wind is high, the dust is disturbed from where it has settled. It is bad wherever the wind comes from, if it blows hard.

Examination continued: On Nov. 5, a similar state of things prevailed. On Nov. 12, the loft was full of smoke; and in the afternoon the blacks were worse than he had seen them for days past. Smoke came into the loft whichever way the wind blew, if it was high. Witness was taken through other entries in November, in which reference was made to a similar condition of things, owing to which the machinery in the rolling-loft had to be stopped.

The OFFICIAL REFEREE asked if any of the butts into which blacks were rolled on these dates were produced.

Mr. GRAHAM said that they had similar exhibits, but not any identified with these days.

One of the test-papers referred to for Nov. 25 was here produced.

The OFFICIAL REFEREE remarked that a good deal of tanning material was upon it.

Mr. CHANNELL said that was so; and there were brown marks down to the time when Mr. Ward ceased to burn spent tan in his furnace.

Mr. DUKE pointed out that on Nov. 30 the original entry as to the wind was "east;" and it had been altered to "south-east."

Mr. CHANNELL: The official record for that date is "east, north-east, and east." There are more entries of south-east wind in Adams's diary than has ever been since the beginning of the world, I should think; it is the rarest wind we have.

Witness went on to give his entries as to days in December; and explained that, though the blacks were very bad, he was sometimes obliged to go on rolling or the leather would be spoiled. In such cases, he closed the louvres, and hung up sheets to keep off the dust. Sulphur fumes were very bad on Dec. 10.

Mr. CHANNELL remarked that he should like to have a copy of the diary of Dec. 10 and 11.

Mr. GRAHAM said copies should be furnished. He might state, however, that Dec. 11 was the date referring to the boxes of dust.

The OFFICIAL REFEREE: Really these dates are always shifting.

Mr. GRAHAM: Well, at first no importance was attached to the date.

The OFFICIAL REFEREE: Since this witness was last examined, a good deal of importance has attached to the dates Dec. 10 and 11. On Friday or Saturday last, it was distinctly stated that Dec. 10 was the date, because then the question arose as to the carpenter who made the boxes on the 11th. It was stated that on Dec. 10 the boxes were seen by Mr. Davis. Now it is said that the 11th was the day.

Mr. GRAHAM: Glanville was also under the impression that it was Dec. 10; and so was Mr. Ward. Mr. Ward is satisfied now that it was the 11th; and that he sent for the box to be made while the Company's witnesses were there on the 11th. At any rate, Adams's diary makes no mention of the boxes on Dec. 10.

Extracts from the witness's diary of various dates to April 27 last were then read. He said that since April 27, they had not found it necessary to stop the machinery.

Mr. GRAHAM: Had you any occasion to stop your machinery at any time in the summer of 1896?

Witness: I think not. I am sure we had not to stop at all last year in the summer.

And it has been your experience, since this mischief began in 1894, that things are much worse in winter and spring than in summer?—Yes.

So that anyone seeing it in the summer, does not see it at anything like its worst?—No.

Witness, further examined, said that smoke could be seen coming out of the coke-shed on any day. There was a tank on the north-west end of the retort-house.

Mr. GRAHAM: I am told that it is the south-west end.

The OFFICIAL REFEREE: I cannot take your evidence, Mr. Graham.

Witness: It is the south-west end. It was my mistake.

Cross-examined by Mr. CHANNELL: Until April 27, or later, he believed that the tank was an opening in the roof. References in his diary to the opening in the roof meant the opening in the west end of the retort-house, or times when the glass of the roof of the retort-house was broken. He did not think that things were worse in the tannery when the glass was broken. If the weather was calm, less damage was done than if it were rough. Oct. 29 and 30 were two very bad days.

Mr. CHANNELL: The official record for those days is: Oct. 29, calm and north-west wind; and Oct, 30, north-east wind. Will you look to your diary, and see whether during the whole of the previous month the wind was more than once southerly?

Witness: On Oct. 24 and 26 it was south-west.

The OFFICIAL REFEREE: His diary shows that the wind was several times south-west during that period.

Witness, further cross-examined, said that the week before May 7, when the Official Referee first visited the tannery, the test-tables were not swept down. In that week, the wind was south-west on some days. The test-tables did not present a worse appearance than usual. On March 18, he stayed up at night to watch the smoke from the gas-works, and see if it was worse than in the day. He made an observation at 2.30 a.m.

The OFFICIAL REFEREE: It is very dark at 2.30 a.m. at that time of the year?

Witness: Yes; but you can see smoke.

By Mr. CHANNELL: He had not corrected his diary since the dates on which it was written up. Additions or corrections might have been made at a later time of the same day.

Mr. CHANNELL: You mean to tell the Court that you have never gone over this diary and corrected mistakes?

Witness: If I have gone over it, I have not corrected it—not to alter it.

There are two dates on which you say "wind still" so and so, when in the previous entry it was something different. "March 8, wind still blowing very strong from west-north-west." Has there been any alteration in that?—No; it is a mistake.

How do you mean?—I should never have said "Wind still north-west," when all the other entries are "west-south-west." I have not altered it since the date it was made, nor corrected it at all.

Further cross-examined: He had never seen any dust coming in with a northerly wind.

The OFFICIAL REFEREE: Just look at your entry of Feb. 14?

Witness: "I visited the works, and found a large amount of dust had blown in during the day. Wind north-west."

Look at Jan. 20?—"Wind north-east, hard. Blacks very bad this morning."

Mr. GRAHAM: What the wind during the night was we cannot tell.

The OFFICIAL REFEREE: Up to the time he makes a note, there is nothing to show that the wind was anything but light. The entry is inconsistent with his statement. I do not see that you clear it up by your explanation.

Witness: I do not say we do not get smuts with a north-east wind.

The OFFICIAL REFEREE: You certainly said so, and that you did not get it with a west wind. A north-east wind blows right from you to the gas-works.

Witness: We get a little smutty soot.

Mr. CHANNELL: There are a number of house chimneys on that side?

Witness: Yes.

By Mr. CHANNELL. He took some dirt from the rain-gutter on Jan. 20, at Mr. Ward's suggestion.

Mr. CHANNELL: Mr. Ward told you to take it out?

Witness: Yes.

Do you recollect that?—Yes; perfectly.

The next entry in your diary says: "Mr. W. O. Ward absent to-day."—It could not have been Mr. W. O. Ward who told me. It must have been Mr. Stanley Ward.

It certainly could not have been Mr. W. O. Ward. I suggest that the whole thing never happened?—I remember perfectly well going to the office.

A report by Mr. Tate and Dr. Hellon on the sample of dust to which this entry in witness's diary referred, was then read. The dust had been sifted by them through the sieve which Adams identified as the one he used to sift previous samples. Rather more than one-third of the sample was left on the sieve. It consisted of scales of slate, brick dust, dirty lime plaster, brush fibre, general road dust, quartz particles, and coal and coke dust adhering. The fine dust passing through the sieve was wholly coal and coke dust, with a few grains of quartz and vegetable fibre. The fine dust in the box was almost identical with the sifted sample.

The OFFICIAL REFEREE remarked that the main point of the report appeared to be that the sifting seemed to leave nothing but coke and coal dust, and to sift out the other extraneous material; so that by sifting they did not get a fair sample of the contents of the shoot.

Witness, in further cross-examination, said that he adhered to the opinion expressed in his affidavit—that the attempts of the Gas Company to prevent the nuisance had increased it, because since they were carried out, not only did the dust issuing from the gas-works enter the tannery, but that accumulated on the screen and roof of the coke-shed was blown there too.

Mr. *R. Stanley Ward*, son of the plaintiff, corroborated the evidence of his father and Adams as to certain circumstances of the case in which he had been engaged. As to the boxes, he said that his father was with Mr. West and Mr. Davis in the rolling-loft; and his father sent him to Adams to ask where the third box was. Adams described its position; and witness returned and found it. There was sacking over the box to the best of his recollection. M'Farlane's story, so far as it related to him, was untrue.

By Mr. CHANNELL: It was impossible that any of the gentlemen in the loft at the time should have found the third box. He had seen the boxes there, but had paid no particular attention to them. On this occasion, he saw two of the boxes on the rolling-table; and his father then inquired for the third, and sent him to ask Adams about it. He did not recollect the third box when Adams was first under examination about it; but he had since thought it over, and remembered it well.

Plaintiff, recalled, said that the references by Adams to him were true.

This closed the plaintiff's case.

Tuesday, July 6.

When the Court resumed this morning,

Mr. CHANNELL opened the case for the defendants. He said it was suggested by Mr. Ward that before the new retort-house was built he sustained no damage at all. As a matter of fact, there must have been a considerable amount of ordinary dust prior to that; and in all probability some of it was from the gas-works. They used to pile the coke in the open air; and there must have been a certain amount of dust in the neighbourhood. The new retort-house was built, and West's charging and drawing machinery was adopted, which was the best thing known for the purpose, and was being used in gas-works generally. It was a labour-saving appliance, and was considered to be more beneficial in every way, both to the Company and to the neighbourhood, than the former

arrangement. In connection with it, the Company adopted the regenerative process of carbonizing, under which there was less smoke emitted than by the process of hand charging. But labour-saving apparatus was not popular. The Company had no trouble with their own workmen; but there were some people—who it was they did not know—who made the apparatus work badly at the commencement. They did not know that it was the Trade Unions; but there were people whom one did suspect in connection with these matters. The dampers were tampered with, and other things done; and the Company, after a time, had to get the place watched. For a short time there was a great nuisance; and they had the whole neighbourhood down upon them. Nobody had persisted in his complaint except Mr. Ward. Although they had been devoting themselves to taking away his ground of objection, and had successfully done so, he had persisted that the thing grew worse instead of better. Their case was that this could not be, and that it certainly was not so. Originally, no doubt, a considerable amount of dust from the coke heap did go over the wall towards the plaintiff's premises; but the specific gravity of the particles was such that they could not travel very far. The steam with the coke carried them up a certain distance; but when the steam condensed, it had the effect of precipitating them. When the wall was low, a certain quantity did go over it; and there was not the slightest doubt that there was a nuisance to Mr. Ward. Partly it would arise from the tampering with the retort-house machinery; partly, probably, from the defendants not having seen exactly what would be the effect of putting coke in this place. Mr. Ward began to take note, and he had had smoke and dust on his mind ever since. He could not see that his grievance had, in fact, been now taken away. The Company put up a screen between the coke-yard and the plaintiff's premises. This was done by the time the first action came on for trial; and they had also fitted the Dulier apparatus to the boiler on the works. This boiler had a forced draught, and was one of the causes of the nuisance in the first instance. Some of the witnesses had stated that this had been absolutely remedied. At the trial on February 15, 1896, it was held that, as there was an admitted nuisance at the time the action was brought, the plaintiff was entitled to the only injunction that could be granted—that the defendants should so carry on the works as not to create a nuisance; and it was referred to Mr. (now Justice) Ridley to assess the damages. In December, 1895, two of the defendants' witnesses certainly suspected, and one intimated to Mr. Ward that he did suspect, that something was going on that was not quite *bona fide* in the tannery. Mr. Newbigging and Mr. Muirhead were shown on the leather dust which, in their opinion, could not possibly have come there naturally. Before Mr. Ridley, witnesses were asked to explain the large blotches or patches, which apparently there was some difficulty in explaining. It was said that he ought then to have charged the plaintiff with fraud, or given him notice that someone in his employ was charged with fraud. But there were difficulties in doing this when there was no direct evidence. Mr. Ward claimed £6000 odd as damages; and a settlement was arrived at by which about half the amount of the claim was paid, to cover all the damage on the leather then on the premises. The process was a slow one, and not a single butt then under treatment had since come through. The damages also included the injury to the liquor on the premises; and there was not one particle of leather down to the present time that had not been through that liquor. But the most important thing in the settlement was that it included six months within which the defendants could take measures which they believed would put an end to any honest claim on Mr. Ward's part. Of course, the damages were nothing in comparison with the injunction for shutting up the gas-works; so that the settlement was one most desirable to make. The cause of complaint at that time was the broken coke, which contained iron that found its way into the tannery. It was said that the spots and blotches on the leather looked nasty, but that they were not nearly so important as the iron which got into the liquor. The Company, at an expenditure of between £4000 and £5000, carried out improvements to prevent what they understood to be the nuisance complained of. They found, however, that Mr. Ward was again moving, even before Oct. 24, when the time allowed for the alterations expired; and shortly afterwards they had notice of motion for contempt of Court for wilfully disobeying the order. One could not help being astonished that the affidavits filed at the time alleged that the thing had become worse instead of better, because erections were put up which physically obstructed the passage of the dust, and means had been adopted for dealing with the smoke. It was said that the Company made more gas in the winter. An answer to this was found in the fact that there were diaries kept by plaintiff's witnesses, showing that the nuisance grew worse as the spring came on, until in the month of April it was the worst ever seen. But though they produced more gas, they made it in the old retort-houses; there was not more made in the new house. Then it was said the nuisance was less in calm weather, but was worse when it was rough; so that, taken altogether, it was worse than it used to be. This was odd, because if the dust came from the gas-works, it could not be more than it used to be, as it did not grow. If, on the other hand, the great bulk of the stuff did not come from the gas-works, the roof of the coke-shed might act as a temporary lodgment for the dust from the plaintiff's own chimney and other places. This, however, did not concern the Company. This was not an injunction against collecting other people's dust or smoke, but against the issue of smoke and dirt from the gas-works. The evidence that the nuisance was worse was mainly that of the diaries; and he asked the Official Referee to hold that these diaries were utterly unreliable. As to the suggestion that dust was scattered about the plaintiff's works, he did not pretend to have evidence of direct complicity on the part of Mr. Ward; but he did ask the Official Referee to rely upon the evidence of the people who had been called to give evidence. Jones, who testified to seeing Adams on the morning of the Friday before Christmas, 1895, sprinkling something from a match-box over the pits, was, even if he was mistaken in what Adams was doing, at any rate telling a story which he believed to be true. It was suggested that the boy M'Farlane was a liar; but, if so, he was an uncommonly good one. It was inconceivable that he would tell such a malicious, wicked story, if there were no truth in it. The other men, who spoke to suspicious circumstances in the tannery, were also witnesses of truth. Besides their evidence, they had the fact that months before something was being done of a similar character so clumsily that many people thought it could not be done naturally. The statement of these witnesses was that when people were coming to examine the tannery there were always plenty of blacks about. In course of time, Adams appeared to have become a little more clever; and when people made remarks about the patches on the leather being too large to be produced naturally, he discovered that by blowing the dust it could be distributed a little more evenly. What he (Mr. Channell) suggested Adams had been doing was that when anybody came to take a sample, he took care to have some blacks about. There was always plenty of dust in the place, but it was not the kind of stuff that would come from the gas-works; and accordingly, on the occasions when people came, blacks were sprinkled over the things, so that they should be black enough. Mr. Reed was one of the gentlemen favoured by Adams in the sense that he had plenty to see when he visited the tannery. One of the samples he produced was described as considerably blacker in appearance than a sample taken by another witness; and it weighed 10,000 milligrammes. The specific gravity of this and other samples was remarkable, and showed that the particles could not have been blown over from the gas-works. This fact afforded the strongest possible corroboration of what had been going on. When the Official Referee visited the tannery on May 7, dust was swept from one of the tables; but it was not stated that these tables had not been swept for a week, and, at all events, that was a week of northerly winds. On the occasion of his second visit, on June 28, the plaintiff seemed surprised to find so large an amount of dust on a table which had been swept two hours before. It had been raining on that day; and the question was where the dust came from. It did not come from the gas-works in two hours in the rain, but was either put there by Adams or was the result of the general dirty condition of the place. The issues in the case were whether a nuisance had existed since the last inquiry, or since October, 1896, and whether it had been abated wholly or partly since those dates. If a nuisance really existed at the date of the previous inquiry, it would continue for some little time until the works intended to remedy it had been completed. Possibly, therefore, the plaintiff might be entitled to some damages for the intermediate period; but this would be an easy matter to settle. Even if the Official Referee found that the defendants had not thoroughly abated the nuisance, he (Mr. Channell) asked him to find that they had tried their best to do so, and had not been guilty of contempt of Court. There had been six different things which had been a possible source of complaint in connection with this case. The first complaint made by Mr. Ward was in reference to the sulphate of ammonia works. But these works had been removed to another building, and improvements introduced which had entirely taken away this ground of complaint. Having dropped the sulphate of ammonia works as an alleged cause of nuisance, the plaintiff now wanted to say that the discoloration of the paint was due to blacks and smuts, though Adams and others had referred to sulphur fumes.

Mr. GRAHAM said, if it was suggested that the discoloration was caused by sulphur fumes, he would ask the Official Referee to find that this was a nuisance.

The OFFICIAL REFEREE: The discoloration of the paint is not of much importance. The only point is that it is alleged that the louvre boards on the side of the premises next the gas-works are blacker than those on the other side.

Mr. CHANNELL said that, at all events, no one would dream of closing the gas-works because a little paint was discoloured. The next thing of which the plaintiff originally complained was the smoke from the boiler chimney, but the introduction of the Dulier apparatus into the chimney had admittedly remedied that. Coke dust from the shed was the main source of complaint at the last inquiry; but it was not now put forward so prominently. Formerly, when only a low wall divided the coke-store and the tannery, coke dust did come over into the premises. But the defendants afterwards put up a screen, and had since roofed it in; and this had entirely put an end to anything that could be a substantial complaint. Another complaint was with respect to the chimney shaft. But what came out of the shaft came from the regenerative furnace, and was gas and not smoke. Experiments and tests demonstrated that the stuff which issued from the shaft was perfectly harmless. Then there were the Dulier furnaces, which certainly could not do any harm. The most serious complaint was, no doubt, what he called the overflow of smoke when the retorts were being drawn. It would be contended for the Company that, though the working of the retorts did produce something which might be objectionable if it got into Mr. Ward's premises, as a matter of fact the specific gravity of the dust was such as to precipitate it into the retort-house, and that what came out contained particles so minute that they could do no harm. The Dulier process, as adapted by Mr. West, was not designed to make the atmosphere in the gas-works pure, but to destroy the noxious effect of anything which might escape; and this was accomplished. Respecting the three boxes and the dust they contained, which had admittedly been dried and sifted and kept by Adams, there was an air of mystery. He could not see how any man of Mr. Ward's position could have thought it an honest and a proper thing to keep, for the purpose of representing the state of things in the gutters, dust which had been dried and sifted, so that it did not represent what it purported to represent. The loft was an odd place to keep such boxes. Nor could he understand what could have led Mr. Ward to deliberately break open one of the boxes, to take out a sample, after it had been sealed for the purposes of the inquiry.

Mr. *Thomas Newbigging*, M.Inst.C.E., examined by Mr. DUKE, said, in an affidavit which was taken as his evidence-in-chief, that he visited the defendants' works in December, 1895, and April and December, 1896. The volume of smoke and dust was much less than under the old process of hand-firing. Smoke and dust were necessarily caused in the work of the retort-house; but the specific gravity of the particles was such that they must be lodged in the building. Experimental plates exposed at the outlet of the Dulier pipe and of the chimney, collected no deposits whatever. He also found that no particles were deposited from a coke-fire which was made in the fitting-shop for experimental purposes. But when he threw upon the fire a handful of spent tar, and held a plate over the fumes, smut and sooty deposits were left on the surface of the plate. He was thoroughly convinced, after the most careful investigation, that there was nothing in the defendants' retort-house which could cause a nuisance. If any damage was caused to the operations of plaintiff by particles of soot, smut, or dust, it in a great measure arose from plaintiff's own chimney. The railway engines were a prolific source of dust; and house chimneys, such as those in the

vicinity of plaintiff's tannery, might also cause a nuisance. In going through the tannery on Dec. 10, 1895, his attention was called by Mr. Ward to certain leather in the drying-loft, and to the marks upon it. The hides were dabbed or splashed with what was evidently coal dust; but it was not deposited as one would expect to find if it was deposited by the atmosphere. It was dabbed irregularly on the smooth or grain side of the leather.

Mr. DUKE: Did that excite your observation?

Witness: Yes; it did. I naturally expected to see smuts on the rough side, rather than the grain side. There were a number of hides in the room; but frequently I found a clean skin on each side of one that was blotched. This surprised me; and I said to Mr. Ward: "Do you mean to tell me these smuts or blotches have been deposited naturally from the atmosphere." He said, "Yes." I replied: "I am altogether of a different opinion. It appears to me that this has been put on the skins artificially." Mr. Ward replied: "There is not a man in my employ who would dare to do that;" and he seemed to be taken aback by what I said.

Did you ask permission to bring away two of these hides?—Yes; I took three away. Two were blotched; and the third, between the two, was perfectly clean. [These skins were produced.]

Were the skins dry at the time?—No, wet; and the dust lay in blotches more distinct than now, as if a finger had been drawn over them.

Examination continued: He observed the dust in the tannery at the time. He was familiar with the dust of a retort-house—for, as a matter of fact, there was little dust in any other part of a gas-works; and he never heard of a case like this, in which dust and smoke from a gas-works were complained of. The dust which he saw about the tannery was different in character from that on the skins, and had not the same shiny coal dust appearance. Mr. Ward called his attention to other skins, which he said had only been hanging for three days. For the previous three days, the wind had been northerly. There was no nuisance from the gas-works at that time. The coke-yard was the only possible source of dust; but he did not believe there was any nuisance. At Wrexham and at Warrington, there were tanneries and gas-works in close juxtaposition. At Wrexham, they sometimes had to complain of nuisance from the tannery. When he last visited the Plymouth Gas-Works—on Dec. 16 and 17, 1896—there was no dust of which complaint could be made. The only use of a retort-house chimney was to create draught. Occasionally smoke was given out for two or three minutes, owing to the presence of a little tar in the coke; but he had never got smuts from tar smoke.

Cross-examined by Mr. GRAHAM: The smuts in ordinary smoke were due to carbon. He could not say what caused tar smoke to be black; but he found that smuts were not deposited. No dust arose from the regenerator furnaces. If dense volumes of smoke came from the retort-house chimneys, it must be due to the burning of tar. Burning out choked ascension-pipes would cause some smoke. The specific gravity of coke or coal dust was so great that it could not escape from the ventilators in the roof of the retort-house. Personally he objected to the ventilators being closed, because he thought it unnecessary. In his opinion, two or three cottages gave out more smuts than the gas-works. He did not know where the dust in the tannery came from. If it was not conveyed by hand, he should say it came from the railway engines.

Mr. GRAHAM: Your suggestion is that it came from the railway, or someone carried it by hand?

Witness: Yes; only I should like to explain that originally the chimney of the boilers, which was fitted with forced draught, did give off smoke and dust. This has, however, been cured.

Now as to the dust on the grain side of the skins. Are not skins hung with the grain side uppermost?—Yes; but if the dust is in the atmosphere, I should expect to find some of it on the under side. All the skins were about as damp as one another.

By Mr. CHANNELL: The only nuisance which could arise in a gas-works was in the process of charging the retorts. This took 1½ minutes with machinery, as compared with 3 minutes when done by hand.

Mr. *John West*, M.Inst.C.E., was then called. His affidavit stated that the Company consulted him in 1894 as to the extension of their works; and a new retort-house, coal-store, exhausters, boiler, &c., were erected. All these were on the most modern principle. After the last inquiry, the Directors gave him instructions to do everything possible to prevent the escape of smoke, blacks, and dust from the works. He carefully stopped the louvres of the new retort-house, so that smoke could not possibly get out, and covered the coke-yard with an iron roof hermetically sealed. The Company had previously placed the Dulier smoke washing and absorbing apparatus in the chimney, where it proved very effective. On his advice, the apparatus was placed in the retort-house, for washing and cleansing the smoke before it went into the outer atmosphere. On one of his visits to the tannery, he noticed marks of dust on the butts in large patches, instead of evenly distributed, as they would have been if deposited from the atmosphere. On one occasion, he saw a locomotive standing on the railway siding near the tannery; and on exposing a plate between it and the tannery, he found that it was quickly covered with dirt from the locomotive. The louvres nearest to the railway were most dirty, although most recently painted.

Further examined by Mr. CHANNELL, witness said he was first consulted when the foundations of the new retort-house were being laid, and had charge of the engineering portion of it. The old retort-house was nearer to plaintiff's premises than the new one; and as hand stoking and drawing was in operation, it took much longer, and more dirt was created than under the present system. The coke was stored about the works, and not in a covered shed. When the new machinery was started, they began all right; but afterwards the dampers of the furnaces were interfered with, the gas was turned out in the retort-house, and the water supply of the condensers was shut off. The effect of these and other things was that, when the retorts were drawn, there was more smoke than there ought to have been. Complaints were made by the people in the vicinity. They cured part of this by adopting the Dulier apparatus for the boiler chimney; and then they put up a screen at the coke-yard. They removed the sulphate plant from the side adjacent to the plaintiff's premises to the middle of the works, where it was examined and passed by Dr. Forbes Carpenter, the Inspector under the Alkali Acts. In his judgment, all substantial grounds of complaint on Mr. Ward's part were removed.

Mr. CHANNELL: Mr. Stevenson said that more dust was made under your system than under the old one?

Witness: That is impossible. The time is shorter; while the coke from two out of the eight retorts in a bed goes direct into the furnaces, instead of being quenched on the floor. We do not use lighter charges in summer than in winter; but fewer retorts are in operation. Witness went on to say that during the last two months all the retorts in the new house were in use; and last winter they also lighted up some of the benches in the old house. The coal breaking and conveying machinery in the coal-store caused no nuisance. A very small proportion of the coal was broken. He had made and assisted in experiments to test the amount of dust given off in the retort-house. The heavy particles fell in the house; and tests had shown that the grey smoke in the roof of the house had no substantial proportion of smuts or dust in it. With the assistance of Colonel Dulier and Mr. Waddington, his engineer, he adapted the Dulier apparatus to the retort-house. In his opinion, the apparatus was efficient in drawing in the smoke and grit. It was not intended to take all the steam of the retort-house. The idea was to deal only with the lighter smoke which ascended; the heavier particles being deposited naturally. The roof and side of the coke-shed were specially designed, and were air and dust tight. In the inquiry before Mr. Ridley, leather was exhibited with patches upon it which could not be covered with the hand. Mr. Ward called attention on some of his visits to large brown blotches on the oiling-tables. These were not pointed out since they ceased to burn spent tan at the gas-works. On Dec. 10, 1896, he went to the tannery with Messrs. Tate and Davis. They took samples from all the pits, and made a general inspection of the place, and saw some hides hung up. On the following morning, they went again and took the dust off hides which had been laid down.

Mr. CHANNELL: What struck you in reference to them?

Witness: Dust was lying on the hides in patches, not evenly distributed as it would be if it came from the atmosphere.

What took place next?—Mr. Tate went with Adams to get some dust off the roof. Mr. Ward said if we wanted stuff from the roof he had got a box of it which the painters had taken. I said I should like to see it. He gave his men instructions to fetch it. At last they found it in a recess behind the rolling-machine, covered with bagging.

Was it one box or two?—One box. I saw a man pull a box off another box. He was about to cover it again, when I told him to bring it out. This second box contained perfectly dry dust, like coke dust; and there was a hollow in the centre, as though something had been taken out of it. There was no lid or cover to the box. I asked Mr. Tate to take samples of the dust, and suggested to plaintiff that the boxes should be sealed. Mr. Ward made no explanation as to the dust. The boxes were taken into the office to be sealed. They were the same boxes as I saw in the loft; and there were only two of them.

Cross-examined by Mr. GRAHAM: It was absolutely untrue that when the Official Referee visited the place he gave instructions to the gas-works men that only half the retorts should be emptied.

Mr. GRAHAM: My suggestion is that you did not use as much water in quenching the coke as usual.

The OFFICIAL REFEREE: The water does not make smoke, Mr. Graham. Is your case founded on the belief that the more steam there is, the worse the annoyance is?

Mr. GRAHAM: Certainly; it is the steam that lifts the smoke.

The OFFICIAL REFEREE: I should say it is exactly the contrary. The more steam there is produced, the less likely is your client to suffer.

Wednesday, July 7.

At the commencement of the proceedings to-day,

Mr. GRAHAM said that plaintiff's solicitor was anxious it should be known that it was by his advice that the seal of one of the boxes of dust was broken. No importance was attached to it at the time.

Mr. CHANNELL accepted the explanation. At the outside, it was only an error of judgment.

The OFFICIAL REFEREE: That was my remark at the time I heard about it.

Mr. *West*, in further cross-examination by Mr. GRAHAM, said that soon after the erection of the new retort-house complaints arose from the occupiers of cottages in the vicinity; and the Company bought the cottages. Mr. Ward complained shortly afterwards; but witness was not convinced that even then a nuisance was caused by the retort-house. He did not remember saying that the retort-house was too near to plaintiff's premises. He could not suggest where the coal and coke dust came from, if not from the gas-works. He had never suggested that plaintiff put the patches of dust on the hides. It did not seem to him that these patches were to be accounted for by the unevenness of the surface of the hides, or by one part drying more quickly than another. When the two boxes were found in the loft, he did not see a third; and no suggestion was made respecting it. There was a difference in the character of the stuff inthe two boxes.

John Noak, foreman in the employ of Mr. Willey, of Exeter, said he superintended the erection of the roof of the coke-shed, and made it dust-tight.

Mr. *J. A. Bellamy*, Deputy-Chairman of the Gas Company, gave evidence as to the situation of various works in the vicinity of the tannery and gas-works, which is the industrial part of the town. The chimneys of all the works emitted smoke. Great quantities of dust also arose from the Corporation stone-yard, the railways, and other places. Witness also spoke to the prevalence of northerly winds in the week preceding May 7, when the Referee visited the works and tannery; and he said there was no portion of the gas-works from which dust, as seen on that occasion, could have been carried by these winds. During northerly winds, clouds of dust were carried from the railway and adjacent works over the tannery. Coal was carried on the railway past the works. He produced photographs showing the emission of smoke from chimneys in the vicinity, and the smoke given out by a locomotive on the siding near the tannery; and also a view of the profuse display of linen hung out from the cottages near the gas-works on a recent washing day. He superintended a number of experiments carried out on June 28, in the presence of the Referee and the plaintiff, to ascertain if dirt and smuts came from the chimneys and the outlet of the Dulier apparatus. Tin plates, freshly painted with white paint, were exposed over the chimneys, as well as at the openings from the retort-house; and in no case were there

any smuts upon them. Some of these tests were made at plaintiff's own suggestion.

Cross-examined by Mr. GRAHAM: It was possible that dust accumulated about the roads in the gas-works might be carried in a gale of wind to the tannery; but he was convinced that nothing came from the retort-house or the chimneys to cause a nuisance to anyone. There was a material difference between the dust collected under stringent conditions by the representatives of the two sides, and that shown to himself on other occasions. He placed no reliance on samples produced without being under supervision. He did not believe that Mr. Ward was personally concerned in preparing any of the samples; but Mr. Ward had dust on the brain, and had believed everything which his men told him. His own experiments convinced him that those of which Adams gave evidence were unreliable.

Thomas Locke, timekeeper at the gas-works, gave evidence as to the exhibition of plates on different dates, to test the presence of smuts and dust in the works, on the boundary wall between the tannery and the gas-works, and in other positions. Some of these plates were fixed in the line of smoke from the tannery chimney; and they had smuts and dust upon them. Others showed the dust coming from the direction of the locomotive engine on the railway siding, and from the Corporation stone-yard. Tins held in the smoke of the retort-house chimney and the Dulier funnel were clean, though at the time the retorts were being charged, and tar was put in the furnaces to produce dark smoke. He made a test on the plaintiff's premises, and found little or no dust.

Cross-examined: He was discharged by the Gas Company on Oct. 23, 1896, and was re-engaged in the latter part of November. He was not dismissed through dishonesty. No charge of any kind was made against him; but he was told the services of a timekeeper were not required.

Mr. *T. Wolferston*, a Director of the Gas Company, explained that Locke was dismissed because a timekeeper was not thought necessary; and he was re-engaged for other work, because they thought his services of value.

The OFFICIAL REFEREE said he did not understand a suggestion against the witness's character being made, apparently without a particle of foundation.

Robert Coombes, a steeplejack, explained the method by which tests were taken of the smoke from the retort-house chimneys and the Dulier funnels.

Mr. *Percy S. Hoyte* gave evidence corroborative of a diary kept by himself and others at the gas-works for March, 1896, recording the direction of the wind, the weather, the conditions as to smoke, &c. There was a considerable amount of smoke from plaintiff's and other chimneys in the neighbourhood.

Thursday, July 8.

When the case was resumed this morning,

A report was put in by Mr. Tate and Dr. Hellon, on a sample of dust taken at plaintiff's request from the gutter of the roof between the retort-house and the coal-store. It was sifted; less than 1 per cent. consisting of larger particles of slate, lime, plaster, glass, quartz, and coal. The fine particles, which went through the sieve, were coal and coke, very much smaller than those found on plaintiff's premises, and differing from them.

Mr. *George Livesey* was next called. An affidavit which he had made stated that he had been acquainted with the gas-works since 1893, and had been there on several occasions. The improvements which had been carried out prevented the escape of dust and smoke. The perfection of the Dulier apparatus in arresting the solid particles of the smoke astonished him. There was no escape of dust from the gas-works which could cause any harm to the plaintiff's tannery.

In answer to Mr. CHANNELL, witness said he had visited the gas-works again that morning, and was still of opinion that all cause of nuisance was removed.

Cross-examined by Mr. GRAHAM: West's drawing and charging machinery was in use in some of the works of the South Metropolitan Gas Company. They adopted it mainly because it was a labour-saving machine. Some dust was caused in drawing the retorts and slaking the coke, and also by the coal-conveying machinery. All this was, however, under cover. His experience was that no appreciable amount of dust came from the coal-store. A little dust would be caused by the filling of the hoppers attached to the charging machinery; but this, too, was under cover, and the dust would be precipitated. He did not see much dust and smoke escaping from the windows on the south side of the retort-house. The great bulk of the dust would go up into the apex of the roof. He had never seen a retort-house shut in as this was. They liked to have them as open as possible. Clearing stopped ascension-pipes did cause some smoke. Tar smoke would cause smuts, which, he should think, would be large and heavy. The cleaning of the ascension-pipes would not cause a great deal of such smoke. The amount would depend to a great extent upon the care taken by the men. In ordinary cases, a considerable amount of dust—mostly fine coke dust—would be found on the roofs and in the gutters of retort-houses.

Re-examined: As the buildings were now, very little dust could escape from the retort-house and adjacent buildings. That morning there was certainly less smoke from the retort-house than he saw from the chimney of a joinery-works in the neighbourhood. There was little or no dust from the chimney of a retort-house. Sometimes smoke appeared from the chimney, owing to defects in the retorts.

Mr. GRAHAM: Whether caused by tar or coal, there would be a considerable amount of smuts in the smoke?

Witness: Yes; there would be smuts, but not many.

Mr. *H. S. Whitmore*, tanner, of Edenbridge, Kent, had made an affidavit as to a visit to the tannery on January 7 last. He found dust about the premises, but not more than he should expect in a tannery. Plaintiff showed him some leather with dust upon it; but he thought it almost impossible the dust could have come through the louvres. The liquor in the pits was old and stale, and had mould upon it. The pits had iron connections, and were strapped together with iron, which was very detrimental to tanning. Nothing would convince him that some of the dusty appearances he saw were caused naturally. Plaintiff's leather was not high class; nor was it made from the best hides. He should call it common mixed tannage. The Dulier apparatus, which had been successfully fixed in the flue of his own tannery, he found to be working satisfactorily in the retort-house of the gas-works. They fitted the Dulier apparatus in their tannery at Edenbridge, because the neighbours complained, and because of the dust deposited on their own premises from their own chimney.

Cross-examined by Mr. GRAHAM: If the Dulier apparatus were temporarily put out of use, his tannery was at once smothered with blacks. He burnt spent tan and coke, which he should say was the usual process. The trouble in his case was that of keeping the place clean. He did not think buyers could tell from the condition of the leather that he suffered as much annoyance as he did from blacks. He turned out clean leather. Plaintiff's leather was the colour that he should expect to see from the liquor he was using. A certain amount of the dark colour was caused by overrolling. Leather could be rolled till it was black. He did not think that smuts had anything to do with the colour of the samples of leather shown to him. Plaintiff's yard and pits were comparatively free from blacks. If the liquor had been darkened and stained the leather, it was not through blacks. Iron would stain the liquor and consequently the leather. When he visited plaintiff's tannery, he did not see any fine dust on the mould on the top of the pits. In the lofts, there was a large quantity of fine coke dust. It covered everything which had not been brushed or disturbed. It was on the sides of the bellies, but not on the top. He told Mr. Ward that the state of things was shocking and disgraceful, and that he never saw such a mess in his life; and he added, in reply to a remark by plaintiff, that it was impossible for a man to carry on a tannery in comfort under such conditions. There was one pile of leather which he saw free from dust and marks; and he congratulated plaintiff on being able to produce such results.

Mr. GRAHAM: Did you believe that this was done fraudulently?

Witness: I believe it could not come naturally.

Why did you not tell Mr. Ward?—Mr. Ward knew that I observed the clean state of the roofs and gutters, and the contrast between the inside and the outside of the buildings.

Re-examined: If the dust had been coming in at the rate that was represented, it ought to have lain a quarter of an inch thick in the disused glue-loft. But there was none there.

Mr. *J. A. Muirhead*, of the Gryffe Tannery, Bridge of Weir, N.B., also gave evidence as to visits to plaintiff's tannery, which led him to the conclusion that the discoloration of the liquor and the dust spread about were not caused by anything which came from the defendants' works. No doubt smuts came into the tannery from the locomotives, and from plaintiff's own chimney. He was struck by the fact that patches of dust and dirt were on the grain side of the leather only, and not on the flesh side, though the flesh side was equally exposed. It appeared to him that plaintiff was prudent in not putting hides into his pits now, as the price of hides was high and that of leather low; and the demand for the leather manufactured by the plaintiff—which was good, but old-fashioned—was decreasing.

Cross-examined by Mr. GRAHAM: Most of the hides and bellies which were hanging had patches of dust and smuts on the sides, but not on the top, where they were hanging over the poles. There were canvas covers over the stands to protect them. Some parts of the leather were quite clean.

Mr. GRAHAM: Did it not seem singular, if this was being done fraudulently, that dust was put on some of the bellies and not on all?

Witness: It looked odd to me to find it in that way. I do not believe that material of this sort and particles of this size would blow over from the gas-works—especially in fine weather, and with a north-east wind such as prevailed when I noticed these appearances, in February, 1896. In December, there was something of the same kind; but not to the same extent.

Re-examined by Mr. CHANNELL: He made a note at the time of his visit in 1895, of his opinion that the dust was wilfully put on the leather.

Mr. *H. V. Prigg*, Borough Meteorologist of Plymouth, gave evidence as to the direction of the wind as officially recorded on various dates.

Mr. *A. Waddington*, an engineer employed by Colonel Dulier for preparing designs and arranging for the fixing of the Dulier smoke absorbing and washing apparatus, said he consulted with Mr. West as to the fixing of the arrangement in the retort-house. A horizontal tube was fixed along the apex of the roof, the lower part being perforated for the admission of smoke; and this horizontal tube was connected with the effective parts of the apparatus. It worked in all respects satisfactorily; drawing in the smoke, soot, and blacks, and preventing the blacks escaping into the coke-shed and the chimney. He made a careful test, and found that scarcely any perceptible dust or soot or blacks escaped.

Other witnesses were called, including two who said that there was absolutely no nuisance experienced by them as tenants of cottages immediately behind the retort-house, and that washing hung out to dry was not dirtied by smuts.

Friday, July 9.

The first witness called to-day was Mr. *A. Wharton*, Manager of the Gas-Works. In answer to Mr. DUKE, he said that on April 23 last men were on the roof of the retort-house repairing it after a gale. It was not true that they were making openings in the roof, as stated by plaintiff. A staff of masons was kept on the works, and all damage of this kind was repaired as quickly as possible. It was not true, as suggested by Mr. Stevenson, that they worked lighter charges in summer than in winter. They had 3¼ cwt. charges, working six hours, all the year round. They did not turn off the water to the Dulier apparatus, and so throw it out of operation. Since the arrangement was put in, the consumption of water on the works had increased 37 per cent., while the increase in the make of gas was only 6 per cent. Each Dulier apparatus used from 1300 to 1500 gallons of water per 24 hours. He was present when the various tests were made; and on each occasion the plates were held so as to catch the smuts if there were any.

By Mr. GRAHAM: In order to make smoke for one of the tests, coal was put into the furnace. No smuts were deposited on the test-plates on that occasion. In the ordinary way, smoke from the retort-house chimney was due to a little tar getting into the furnace, or to leakage of the retorts. Cleaning out ascension pipes caused some smoke. This went up into the lantern of the roof, and was drawn into the Dulier pipe. He had seen smoke come from the windows on the south side of the retort-house when

the retorts were drawn; and he had noticed that it rose as high as the roof of the coal-store. He had not seen any volume of smoke rise above, and blow over the roof of, the retort-house. He had been to the tannery on many occasions, and had visited it frequently at the plaintiff's request. His attention had been drawn to dust about the place, particularly in the drying-loft; and plaintiff told him that it had been coming in.

Mr. GRAHAM: Have you seen dust and smoke blowing about the tannery?

Witness: No; I have never seen any blowing about. I have seen dust there.

According to you, there has not been any nuisance?—I have never said so. Before the roof of the coke-shed was put up, there was a nuisance. When there is a big heap of coke, and a slip occurs, dust will arise.

You are constantly moving this coke?—Yes; and at times there are considerable falls in working the heap. There is some draught in the coke-shed when the wind is high.

The OFFICIAL REFEREE: I did not notice any draught when I was there; and I do not see how any could be caused by a north wind, for instance.

Mr. GRAHAM: And when dust is made it gets outside?

Witness: I have not been able to find it so; and I have made many tests.

The OFFICIAL REFEREE: If it does get out, does it get to you?

Mr. GRAHAM: Directly it gets outside it comes over the wall to us.

The OFFICIAL REFEREE: Not in every wind.

Mr. GRAHAM: In any wind blowing in that direction. The buildings run nearly east and west; and I say that if the wind is blowing from the south, it comes in at the openings of the coal-shed, blows through the retort-house, and out through the coke-shed.

The OFFICIAL REFEREE: Which is closed on three sides.

Mr. GRAHAM: I say it would blow out at the west, and into our tannery.

The OFFICIAL REFEREE: I should say it would exactly miss your tannery, as you describe it.

Mr. GRAHAM: It would go very accurately if it did.

The OFFICIAL REFEREE: You were making it go very accurately yesterday or the day before.

Witness, further cross-examined, said he inspected the gutter between the retort-house and coal-shed a few days ago, and found about ¾ inch. of fine coal and coke dust. He could not say where it came from. Mr. Ward had pointed out to him dust on the louvre boards, poles, and leather. The receptacles of the Dulier apparatus had been cleaned out on several occasions. There was a little dense grit on it; but the bulk of the matter went down the drains. At first, they collected a good deal in the apparatus attached to the boiler-house chimney. There was not the same quantity now, because they had not got forced draught on.

Mr. *F. H. Tate*, F.C.S., analytical chemist, of Liverpool, was examined by Mr. CHANNELL. He said he was acquainted with gas-works construction. The works of the defendant Company were of the most modern style. The best possible means had been taken, at very great expense, to prevent any damage or nuisance to the neighbourhood; and he had found no evidence that any such damage or nuisance was caused. Dust taken from the top of the retort-bench and from the plaintiff's sheds showed a very marked distinction—so much so as to suggest that the dust on the plaintiff's premises came from other sources. There was a considerable proportion of animal and vegetable fibre in the samples of dust from the tannery; and this, taken in conjunction with experiments which he had carried out at the tannery at Edenbridge, where they burnt spent tan and coke, and with the fact that the plaintiff used the same kind of fuel and that his chimney was not very high, led him to the positive conclusion that most, if not all, the dust came from the plaintiff's own chimney. There was no evidence that it came from the gas-works. There was a good deal of smoke from other works in the neighbourhood; and dwelling-houses also contributed dust and smoke. The Dulier apparatus in the retort-house was effective, and was doing good work in preventing the escape into the atmosphere of particles of soot and dust. He had taken a sample of the air issuing from the coke-shed during the drawing of the retorts and slaking of the coke. The air gave no indication of the presence of coal or coke dust. The tests which he had had made, by holding tins covered with paint or whitewash in the smoke as it issued from the chimney stacks, were such as would detect the presence of smuts if they existed in any quantity. If the gases given off by the furnace were coloured by tar or coal smoke, it would not be injurious, because it would continue for a very short time. He analyzed the samples of dust taken from the boxes kept in plaintiff's rolling-loft. He did not know then that the dust had been sifted; but he remarked in the report at the time that the proportion of small dust in the sample was very much greater than in another sample which he had himself taken from the gutters. The samples of dust swept up in the rolling-loft by Adams, and produced by Mr. Reed and Mr. Taylor, were of heavier weight than those taken under similar conditions by other witnesses. He could not account for this difference. Three samples of dust taken from the Corporation stone-yard, where there was a stone-crushing machine, contained 4·2, 8·45, and 9·46 per cent. of iron respectively. But this would be practically insoluble in tan liquor, and would not account for the iron dissolved in the liquor. It might, however, account for the insoluble iron particles found on chemical analysis to be in the liquor. His analyses of the samples of dust taken from the tannery under different conditions showed that the strength of the wind, rather than the direction of it, affected the amount of dust found on plaintiff's premises. He saw the boxes of dust on plaintiff's premises on the day they were produced and sealed. He did not see a third box.

The OFFICIAL REFEREE: Is there much iron in ordinary soot?

Witness: I should not expect to find as much iron in it as there would be in coke dust, because to a certain extent soot is a product of distillation. I think the greater proportion of the iron would be left in the ash.

What iron there was in it would be soluble in tan liquor?—I think so.

Cross-examined: Iron was in everything; and some in all tan liquor. Between the time the two boxes were produced, and the sealing of them up, there was an opportunity to produce a third box. Under any circumstances he should expect to find road and other dust in the tannery.

Mr. *John Thomas*, Secretary to the Gas Company, said that since the last inquiry before Mr. Ridley, the Company had spent £4200 for the purpose of preventing nuisance. The items of expenditure included the cost of an iron roof for the coke-store, the Dulier apparatus, filling up the openings in the east-end of the retort-house, and putting a cover at the entrance to the coal-store.

This concluded the evidence for the Company.

Mr. GRAHAM said that he should not now be prepared to sum up the case for the plaintiff. It was a matter of great importance to his client; and as there was a charge of fraud involved, it was necessary that he should go into the various questions at some length, and in detail.

The OFFICIAL REFEREE: I do not think there is any reflection cast upon Mr. Ward, though no doubt there is upon some of those in his employment. Undoubtedly Mr. Ward has done one or two things which, it seems to me, he would not have done if he had had any suspicion. Still, as regards persons in his employment, there are serious questions raised; and if you say you want more time than you can have now, you must have it.

Mr. GRAHAM said that he had been placed in a rather peculiar position by the absence of Mr. M'Call, who had had to return to London; and he really did not feel that he could deal properly with the case without more time.

The OFFICIAL REFEREE: If you feel that, I cannot say another word. You must have what you consider a reasonable and proper opportunity of dealing with the case in a satisfactory manner, both to yourself and your client.

Mr. CHANNELL said that he had shortened his evidence a great deal for the express purpose of finishing the whole thing, and in order to get the matter disposed of before the Long Vacation.

The OFFICIAL REFEREE said it might be possible to give the parties two days in London for the speeches before the Long Vacation.

Plaintiff and Mr. *Ellis* were recalled to rebut some of the evidence of defendants' witnesses; and,

The case was then adjourned *sine die*.

A Certificate Not "Conclusive" Evidence of the Correctness of a Meter.

At the Richmond Petty Sessions yesterday week, Mrs. Tayleur, of Dynevor Road, Richmond, was summoned for £16 14s. for gas supplied by the Richmond Gas Company from Christmas to Lady-day. Defendant, for whom Mr. Crawshay appeared, pleaded that the gas bill in the corresponding quarter of last year was only £2 11s. 11d. The only difference in the fittings or quantity of gas consumed was that there was now a gas-stove in the dining-room; and this was only alight during breakfast and dinner. Mr. Burrell, for the Gas Company, submitted a certificate of the London County Council Gas Examiner to the effect that the meter was correct, and contended that the Bench must accept the certificate that the meter was correct, and upon that he claimed the full amount. The Bench, however, ruled that the Act of Parliament made the state of the meter only *primâ-facie* evidence, and they therefore reduced the amount claimed to £6 6s. 11d.

The Kingston-on-Thames Gas Company and Incandescent Lighting.—The Malden and Coombe District Council have accepted an offer of the Kingston-on-Thames Gas Company to fix incandescent burners in the public lamps free of cost, and to light, maintain, and extinguish them for £3 7s. 6d. per lamp per annum. The contract is to extend to three years.

Opening of New Water-Works at Shoeburyness.—The new water-works which the Shoeburyness District Council have had constructed from plans prepared by Mr. Mansergh, at a cost of £12,400, have been formally opened. The water is obtained from a depth of 475 feet; and the machinery, which is all in duplicate, is capable of pumping 200,000 gallons per twelve hours, with a depression in the well of not more than 50 feet. The water-tower is 60 feet high; and the tank at the top will hold 43,000 gallons.

Reduction in the Price of Gas at Middleton.—At the last monthly meeting of the Middleton Town Council, Alderman Walker, in moving the adoption of the minutes of the Gas Committee, announced that they had found it within their power to lower the price of gas. The reduction for the public lamps was 6d. per 1000 cubic feet, which would no doubt assist the Lighting Department in the better lighting of the district. For other purposes they had reduced the price 1d. per 1000 cubic feet, which brought the price to 3s. For purposes of cooking, &c., they had taken off 2d.; bringing the price to 2s. 8d. The minutes were adopted.

The Liskeard Corporation and the Water-Works.—The Liskeard Town Council have entered into negotiations with the Liskeard Water Company for the purchase of their undertaking. An offer of £16,500 has been made for the works; and the Directors are in favour of a sale at this price. A special meeting of the Company has been convened to consider the proposal; and if they sanction the sale for the sum named, the matter will come formally before the Council. The undertaking was formed in 1859; and it affords a pure and abundant supply of water to the locality. The paid-up capital is £5100, in 600 shares on which £8 10s. each has been paid; and the Company have for several years paid a dividend of 9 per cent. per annum. The Corporation hope to borrow the amount of the purchase-money at 3 per cent.

Shocking Fatality at the East Warwickshire Water-Works.—The works of the East Warwickshire Water Company were the scene of a sad accident a few days ago. Extensive alterations and additions are in progress; and the resident foreman, Isaac Thornton, with an employee, were down the well putting the finishing touches to a new pumping apparatus. The shaft up which the water is drawn from the spring is nearly 800 feet deep; and the men were at work 540 feet from the surface. Suspended above were the pump-rods (weighing something like 5 or 6 tons), hanging on a chain; and it is stated that Thornton had occasion to gently move the rods. Without warning, the chain snapped; and the rods fell down the well on to the unfortunate foreman, whose death must have been instantaneous. At the inquest, a verdict of "Accidental death" was returned.

MISCELLANEOUS NEWS.

THE EXAMINATIONS IN GAS MANUFACTURE.

The Pass List.

The following are the names of the successful candidates in the last examinations in "Gas Manufacture" by the City and Guilds of London Institute :—

HONOURS GRADE.

First Class.—Canning, J. H.; Riley, H. E.

Second Class.—Baker, A.; Bingley, J.; Brown, J. H.; Capp, H. E.; Davies, G. S.; Davies, H.; Guiver, J. N.; Hallaway, J. P.; Moon, P. G. G.; Power, J.; Strivens, C. J.; Tagg, S.; Watkins, J. T.; West, F.; While, H. S.; Williams, P. E.

ORDINARY GRADE.

First Class.—Bairstow, H. M.; Bottomley, J. W.; Cowper-Smith, A. T.; Dougall, A.; Dougan, O. W.; Edwards, H. G.; Ford, W.; Key, W. J. R.; Mann, J. C.; Peattie, T. B.; Richmond, F. D.; Smith, H. E.; Tew, W. E.; Thomas, J. M.; Walker, T. B.; Williams, H. S.

Second Class.—Alexander, W.; Barrett, F.; Baxendale, W.; Brown, A. E.; Brunton, H.; Buckley, A. E.; Bunch, H.; Campbell, J.; Cheshire, H.; Cleasby, P. C.; Dew, D. J.; Duff, W.; Ewing, W.; Fowler, J. F.; Garlick, D. E.; Gleig, L. F.; Godwin, J. W.; Halliwell, A.; Halliwell, S. E.; Halsted, W. A.; Higginson, F.; Hislop, L. R.; Holt, J.; Jones, A. O.; Judd, W. M.; Kay, H.; Keillor, G.; Marsden, H.; Matterface, H.; Miller, J. S.; Nairn, A. G.; Nash, W. H.; Newton, W. H.; Nisbet, A. S.; O'Neill, T.; Page, C. W.; Port, H. N.; Reilly, E. P.; Rolph, G.; Shepherd, G.; Stanton, H. V.; Stone, A. W.; Turner, J. W.; Twycross, L. E.; Urquhart, J.; Walker, R.; Weaver, A. S.; Wilson, H. F.

The question papers set for the examination were given in the "JOURNAL" for May 11 last (page 1072).

THE ACCIDENT TO THE ROPE-GUIDED HOLDER AT MIDDLESBROUGH.

Mr. Henry Woodall's Report.

In last week's issue of the "JOURNAL," a paragraph appeared mentioning the fact that Mr. Henry Woodall's report on the recent accident to the rope-guided gasholder at Middlesbrough had been discussed at a private meeting of the Corporation Gas Committee on the previous Friday afternoon. The paragraph also stated "that Mr. Woodall did not attribute the accident to the sinking of the foundations, but to the breaking of one of the guide ropes, through which some of the brackets had been wrenched off, and, falling between the lifts, had jambed them." We have since received a copy of Mr. Woodall's report; and it will be seen that he does not primarily attribute the mishap to the breaking of the ropes. After going into the history of the foundations of the tank, he shows that the inlet and outlet pipes had gone out of plumb nearly 2 ft. 6 in., and that the tank-guides were so out of plumb that the holder twisted as much as 5 inches; and it was this twist which caused the circumferential fittings on the outer lift to break. Mr. Woodall's report is as follows :—

In March last, I had the honour to receive instructions to report as to the nature and cause of an accident which had befallen a rope-guided holder, at your Marsh station; and also as to the Contractors' liabilities under their guarantee. Acting upon these instructions, I have paid several visits to Middlesbrough, and have given considerable time and care to the inspection of the holder, before and after the water was run out of the tank; and I have now pleasure in submitting the results of my investigations.

The holder in question is of three lifts 30 feet deep, and is contained within a steel plate tank 186 ft. 6 in. diameter, which rests upon the surface of the ground, and is entirely without support, other than the guide-rails within, which are primarily intended for the guidance of the holder. This system was adopted because of the extraordinary trouble and expense which were entailed in the construction of a brick tank some fifteen years before, upon adjoining ground, when, as I understand, a second tank had to be built within one first constructed, because of the faulty character of the latter.

The foundation of the new tank (No. 5) now under consideration is of concrete, 3 feet thick, resting upon a natural bed of clay, 5 feet thick. Below this, the ground is admittedly of a very unstable and marshy character. Under these circumstances, it was most natural that the management should have resolved to try a system of construction, of comparatively recent invention, which had found many advocates, and which seemed specially adapted for the peculiar conditions which the Committee had to cope with.

From the first there has been subsidence of the concrete foundations; and though recent surveys have shown that the rate of sinking is gradually lessening, it has not yet ceased. The subsidence is not regular over the whole area, but differs from the original level, from 9 inches to 17 inches, as between the highest point towards the east, and the lowest towards the west. The difference between one side and the other of the tank is now about 6 inches; but within there is a further sinkage of 12 inches towards the centre. The weight of the tank (which empty is 470 tons) has caused the concrete to incline at a considerable angle; and the slope, which is apparent from without, continues within the tank to the extent of about 20 feet, so that the section of the tank bottom is that of an immense dish, the sides of which shelve downwards for 25 feet to the bottom, which is flat, but slightly inclined to the east. The inlet and outlet pipes, which are of wrought iron, enter the tank within the area of this slope, and are thrown out of perpendicular thereby to the extent of 2 ft. 4 in. in their length of 32 feet.

Coming now to the accident, it appears that it occurred after midnight of Feb. 20, and presumably about 3 a.m. on the 21st; for there is evidence that the man in charge of the holder, going on duty at 5.30, found it in the act of falling, through loss of gas, which was then escaping through the cup of the upper lift. When this man (John Singer) left the holder at 11.45 on the previous night, it contained about 2 million cubic feet of gas; and it stood about 81 feet above the water-level of the tank—that is to say, two lifts were full, and 20 feet of the third. On his reappearance in the morning, the third lift was empty; the second was about 4 feet out of water; and, as I have stated, the gas was escaping through the cup of the upper lift, from which the water had all disappeared. There was a crack about ¼in. wide through a tank plate, in the second row from the bottom, from which water was issuing freely. Mr. Terrace informs me that the loss of water from this leakage was about 1 ft. 6 in. He took measures to stop the leak at once; and immediately began to refill the tank.

On the occasion of my first visit, March 10, I found the upper lift full; and, in order to test the cup, I had a quantity of gas admitted, which brought the bottom of the cup well above the level of the water in the tank. This condition was maintained for several hours; but no diminution in the quantity of water contained was discernible. The escape of gas had, therefore, not occurred through any defect in this cup. As for the cup of the second lift, there is some proof that this also is undamaged. It continues to hold water while on the landing-stones, so far as it can; but, owing to difference of level, the cup cannot be filled all round.

In what direction, then, are we to look for the cause of the accident? There was a strong wind blowing when Singer made his last inspection for the night, at 11.45; and he says that, as he walked round the platform, he found it necessary to hold on by the handrail. The night-watchman at the gas-works testifies to a squally wind, which was highest between two and three in the morning; and a Shields meteorological report, the most reliable for the locality procurable, records a wind travelling at 37 miles an hour, which maximum was reached at 3 a.m. Still, both of the men I have quoted assert that there was nothing remarkable about the wind, and that the holder had been exposed to greater gales before. This wind appears to have blown from the south-west; and there is distinct evidence of the holder having been twisted by a force from that quarter. The wheels have been forced from the perpendicular guide-rails in many instances, and, with several exceptions, from the south towards north, until the strain could go no farther, which was about north, near the cracked plate.

I am of opinion that under the strain of this torsion, when a number of wheels were off the guides, one of the four-sheave pulley blocks, round which the rope is geared horizontally, gave way; and, one having given, others followed in quick succession. The breakage of these caused the holder to cant over from north to south. The broken castings, &c., tumbled all about; and sometimes fell between the holder and tank, and, getting fixed in descent, tore great gashes in the side-plates of the holder when afterwards it began to descend. The list which the holder acquired, after the breaking of castings and ropes, partially emptied the lutes of water, and enabled the gas to escape. At the same time, the bottom curb, owing to the list, was being forced (under enormous pressure) against the tank-plates on the north side; and this force has been sufficient to bend upwards both the angle-iron rings of the curb, the bottom one more especially, over a length of at least 50 feet. Several pieces have been wrenched out of the curb by contact with the tank in its descent. No wonder a plate was cracked under such circumstances!

Looking at all the evidences which have presented themselves to me, I cannot doubt that the system of circumferential guiding which is applied (I believe, for the first time) to the third lift is defective, and has been the cause of this unfortunate accident. The strains to be resisted are varied and severe; and too many fittings are necessitated, the breaking of any one of which imperils the whole. Of the eighteen four-sheaved blocks round the tank, which had to bear a lateral strain, eleven gave way!

It is worthy of note that the three lifts have throughout worked together, and have unitedly become dissociated from the tank bearings, and that the two upper lifts are practically unaffected by the accident. These, I need not remind the Committee, are guarded by the original system of diametric gearing; and that they should have come safely through such an ordeal, should occasion the fullest confidence in putting the system to further trial.

I have no hesitation in recommending the Committee to permit the Contractors to reinstate the holder, substituting the diametric system for the circumferential in the case of the third lift. In their letter of the 15th of June, Messrs. Ashmore state their willingness "to replace all the ropes and their fittings at their own expense." At this date, however, they were not aware of the other injuries which the holder had suffered. But, as these are all consequent upon the failure of the cables and their fittings, I consider the Contractors are responsible, under their agreement, for all the damage done to the holder. I see no reason to cut out the cracked plate, as has been proposed, and would simply cover the crack with a joint plate.

This accident has revealed, in my opinion, a great unsuitableness in the ∧ kind of guide-rail, which is employed in the tank. Useful as any, no doubt, so long as the vessel is working truly, it becomes an engine of destruction when once the holder is off its bearings. In the present instance, the bottom curb has been sheered into by these guide-rails in at least eight places, to the extent of from 3 to 5 inches. I do not consider the Contractors in any way to blame in this matter, for this kind of guide is in general use; but I would recommend the substitution of ⌣ channel or other suitable shape for the tank-guides, and that the Committee should bear the expenses of this alteration.

Owing to the deflection in the tank bottom, to which I have referred, the plates covering the concrete have been put under considerable tension. I would advise that a careful examination be made of these; and it may be expedient to cover the surface with asphalt of a character to fill up any crack which may occur in the future, especially as the concrete bed must already be broken.

I wish to take this opportunity of expressing my indebtedness to Mr. Terrace for the frank and perfectly open way in which he has afforded me all the aid and information I have asked for.

MANCHESTER CORPORATION GAS AND ELECTRIC LIGHT SUPPLY.

Annual Accounts—Price of Gas in the Out-Districts—The Working of the Electricity Department.

In the last number of the "JOURNAL," we gave the report on the working of the Gas Department of the Manchester Corporation for the year ending March 31. We now reproduce some figures from the accounts.

PROFIT AND LOSS ACCOUNT.

INCOME.

Gas-rental—			
Ordinary meters		£414,985 12	4
Prepayment meters		8,183 12	4
Public lamps		36,742 10	8
Meter-rents (beyond the city)		2,929 1	2
Stove-hire		2,009 17	6
Residual products—			
Coke	£37,603 13 3		
Tar	31,649 19 3		
Ammonia water	18,448 2 4		
		87,701 14	10
Rents of cottages, &c.		264 1	0
		£552,816 9	10

EXPENDITURE.

Cannel and coal (including cost of unloading, &c.)		£233,335 0	7
Retort men's wages		45,838 4	11
Retorts, fire-bricks, &c. (including cost of setting)		13,579 19	7
Repairs and maintenance of works, mains, &c.		55,182 16	4
Purifying material and wages		3,050 16	8
Salaries and wages of clerks in Superintendent's office, rental and inquiry offices, and meter inspectors		18,798 17	5
Collectors', receivers', and cashiers' salaries		7,871 11	1
Rents, rates, and taxes		29,690 0	7
Renewals of plant, &c.		20,707 5	3
Bad debts		412 3	11
Miscellaneous expenses		5,016 11	8
		£433,593 8	0
Balance		119,223 1	10
		£552,816 9	10
Interest		£33,153 0	4
Sinking funds		17,745 10	3
Balance (net profit on the year's working)		68,324 11	3
		£119,223 1	10

The balance of net profit is applied as follows:—

Amount paid over to the city fund account	£40,000	0	0
Suspense account in connection with expenditure on carburetted water-gas plant	28,324	11	3
	£68,324	11	3

The accounts proper are followed by the usual appendices, giving statistics as to the progress of the gas undertaking during the year.

The figures in Appendix A—a statement of the lamp and private rental, including meter and stove rents, derived from within and beyond the city—have already been given when dealing with the profit and loss account.

Appendix B is a comparative statement of the gas transmitted from the works in the daytime and during the twenty-four hours, for the past two years. Summarized, the figures are as follows:—

	Daytime. Cubic Feet.	Twenty-four Hours. Cubic Feet.
Year ended March 31, 1896.	982,982,000	3,762,570,000
Do. do. 1897.	1,136,285,000	4,182,339,000
Increase	153,303,000	419,769,000

	Cubic Feet.
Quantity of gas transmitted from works	4,182,339,000
„ measured and accounted for	4,007,387,000
Loss (by condensation and leakage).	174,952,000, or 4·18 per cent.

In Appendix C, particulars are given as to the results of the working from June 24, 1881, to March 31, 1897. The table contains statistics as to the number of tons of coal carbonized, the total make of gas, the percentage unaccounted for, the yield per ton of coal, the illuminating power of the gas, the quantity of residual products, &c., for each year in the above-mentioned period. The particulars for the past financial year are as follows: Coal and cannel carbonized, 408,064 tons;* gas made, 4,179,767,000 cubic feet; yield per ton of coal carbonized, 10,243 cubic feet; illuminating power, 19·16 candles; make reduced to 20-candle power, 4,004,216,000 cubic feet; make per ton, 20-candle power, 9813 cubic feet; make of coke, 254,595 tons; do. per ton of coal, 12·51 cwt.; make of tar, 26,692 tons; do. per ton of coal, 12·80 gallons; make of ammoniacal liquor (10-oz. strength), 11,973,198 gallons; do. per ton of coal, 29·43 gallons.

Appendix D shows the number of stoves and of each size of meter in use during the year in the city and out-townships. At the close of the past financial year, there were 6996 stoves in use within, and 2407 beyond the city—together, 9403. Of these, 2991 were on hire within, and 1103 beyond the city (together, 4094), as compared with 2828 and 953 (together, 3781) at the corresponding date in 1896; so that there was an increase of 313. The number of meters in use was 100,647 in 1897 and 87,242 in 1896. There was last year a net increase of 13,405 on the number for the preceding year. Of the total number at work on March 31 last, 92,447 were on hire, as compared with 78,559 at the close of the financial year 1895-6. The number of prepayment meters on hire on March 31 last was 13,959—an increase of 10,076 on the number at the close of the preceding year.

From Appendix E we learn that the gas-mains laid last year within the city amounted to 21,060 yards, and beyond the city to 13,056 yards—a total of 34,116 yards, or 19¼ miles 236 yards. The mains taken up were 7935 and 3353 yards respectively—a total of 11,288 yards, or 6 miles 288 yards. The total net increase during the year therefore was 22,828 yards, or 12⅞ miles 388 yards. The total length of mains laid at March last was 1,319,390 yards, or 749¼ miles 270 yards.

Appendix F consists of a statement showing the amount of gross profit made from the gas undertaking, and the mode of its appropriation, also the amount of borrowed money owing, excess of assets, &c., from 1862 to March last. The figures for the past financial year are as follows: Profit, £119,223; paid over for improvement purposes, £40,000; transfer from contingent fund, £9337; borrowed money owing, £926,088; and excess of assets, £989,506. The profit of £119,223 is appropriated thus: Interest, £33,153; liquidation of mortgage debt, £17,745—leaving a surplus of £68,324.

The report and accounts came before the Council at their meeting last Wednesday—the LORD MAYOR (Alderman J. Foulkes Roberts) in the chair.

Alderman GIBSON, in moving the adoption of the report, said the Gas Committee had had an exceedingly prosperous year; the consumption of gas having been considerably larger than in any other year in the history of the gas undertaking. It might, perhaps, be interesting if he were to compare the growth of the gas business during the past ten years. In 1887, there were 77,655 consumers; in 1897, there were 100,647—an increase of 30 per cent. In 1887, the total quantity of coal and cannel carbonized was 292,335 tons; in 1897, it was 408,064 tons. The price of gas had been reduced in the ten years by 15½ per cent.—viz., from 2s. 8d. to 2s. 3d. per 1000 cubic feet. Each consumer now took 10 per cent. more gas than he did when the price was 2s. 8d. In 1887, the average consumption per consumer was 36,426 cubic feet; in 1897, it was 39,816—an increase of a little more than 9 per cent. Other evidence of the growth of the undertaking was found in the fact that the length of mains had been increased in the ten years by 92 miles. This had been most marked in the large-sized mains. In 1887, there were 657 miles of mains; now there were 749 miles. The increase of 11 miles in the largest-sized mains showed that the increased consumption had been chiefly from a distance; mains of greater diameter having had to be placed in order to secure the proper pressure. With regard to the gas-meter department, there had been a great development in the large-sized meters also. In 1887, there were 857 50-light meters; now there were 1280. In 1887, there were 380 100-light meters; now there were 614. At the first-mentioned date, there were 120 150-light meters; now there were 155. In place of 72 200-light meters, to-day there were 102. As to the balance-sheet, in 1887 the total capital expenditure was £1,355,020; that for 1897 was £1,833,851, or an increase of £478,831. At the same time the mortgage debt of the department had only grown by £140,246. The excess of assets over liabilities in 1887 was £694,150; to-day it was £989,506—an increase of £295,356. In addition to this, the Committee had set aside during the ten years £181,675 for the reduction of the debt; £132,417 had been written off for depreciation; and the rates had been relieved out of the gas profits during the same period by more than £500,000—and all this notwithstanding the substantial reductions in the price of gas which had taken place in the period under review. He thought he had said sufficient to justify him in asking the Council to pass the report.

Mr. BRIGGS seconded the resolution.

Alderman SMITH congratulated the Gas Committee on the success of their undertaking.

The report was approved.

Alderman GIBSON then moved that the Council should consider the recommendation of the Gas Committee to reduce the price of gas in the out-townships to 2s. 6d. per 1000 cubic feet, and to abolish the charge for the hire of meters in such out-townships, as from the 29th of September next. He said it would be in the recollection of the Council that he moved a somewhat similar resolution twelve months ago; but at that time they—unwisely, as he thought—refused to accede to it. On that occasion, he had not a unanimous Committee; and he believed one or two of the members spoke against the proposal. Since then, much had been learned; and he now came backed by a unanimous and united Committee, and with the fullest hope of securing the acceptance of his proposal by the Council. The Committee had arrived at the conclusion that if it was just and equitable to charge in the out-townships a differential rate of 10 per cent. ten years ago, or rather more, when gas was 5s. per 1000 cubic feet, it was not unfair and inequitable that they should be charged a differential rate of 20 per cent. now, when the price of gas was 2s. 3d. It seemed to him that there was no answer to give to any other course being pursued. If it was fair to charge the out-townships 10 per cent. when the cost was 5s., it must be fair to charge them 10 per cent. to-day. The Committee proposed to have in the out-townships a uniform differential rate of 3d. per 1000 cubic feet over the price paid by the citizens of Manchester; and he trusted the Council would not offer any impediment to the successful working of the great undertaking in which the Committee took such an interest. The experience of the Committee showed that whenever a reduction in the price of gas was made, they recouped themselves in something less than three years. In 1890, they reduced the price from 2s. 8d. to 2s. 6d. per 1000 cubic feet. At that time they carbonized, in round figures, 302,000 tons of coal and cannel. In 1891, the quantity was 346,000 tons; in 1892, 351,000 tons; and in 1893, 365,000 tons. In three years, therefore, they more than made up the loss sustained by the reduction in the price. What did they do in 1895? In that year, the Committee, in his judgment, made the boldest stroke ever suggested by a Gas Committee. He was proud to say that the Council rose to the occasion, and supported the Committee in the efforts they were making to increase their business and promote the best interests of the gas consumers. From March 31, 1895, they agreed to reduce the price to 2s. 3d. per 1000 cubic feet, and to abolish the charge for meter-rents within the city. He was justified in calling it a bold stroke, because by it they at once lopped off from the revenue no less a sum than £53,000

* Including the equivalent of enriching material. The residuals are calculated at "per ton of coal" only.

a year. What, however, had happened since then? In 1895, the revenue from the sale of gas at 2s. 6d. per 1000 cubic feet was £456,811. In 1896, gas at 2s. 3d. produced £420,999, or £36,000 less than the year before. But in 1897, the revenue was upwards of £10,000 more, at 2s. 3d., than it was in 1895 at 2s. 6d. This, he thought, was a sufficient answer to anyone opposing; and it justified the Committee in asking the Council to agree to the reduction. The proposal to abolish meter-rents in the out-townships meant a loss of £3000; and the reduction in the price of gas amounted to £7250—together, £10,250. He ventured to say, in face of the report which the Committee had presented, that this was not a very serious matter for them to undertake, or for the Council to grant. He should point out that the proposed reduction would only affect the Committee for half the present financial year. In some of the districts where it was proposed that the reduction should take place, there was hardly a small house that had gas laid on; and scarcely any gas was consumed, because the cost was too great. In his view, the reductions he proposed would be a great boon to the people who consumed gas in the out-townships, and who could not afford to pay the present price; and he believed also that it would bring an enormous amount of "grist" to the "mill" of the Committee.

Mr. J. Briggs seconded the motion.

Alderman King said he had no feeling of opposition to the Committee; but, as Chairman of the Finance Committee, he felt he ought to watch very carefully, at a time when people complained of the increase in the rates, any proposal that might have the effect of adding to their burdens. The reduction of £10,000 referred to by Alderman Gibson, would mean about ⅜d. in the pound. In this light, he thought the Council should consider whether it was desirable to accede to the suggestion now made. He did not propose to move an amendment; but he wished the Council to remember that they were likely to be £10,000 worse off if the recommendation were accepted.

Mr. Greenhow agreed with Alderman King. He said it seemed to him that the present was the wrong time to reduce the price of gas to the out-townships. It might be just; but charity should begin at home, and those who happened to be ratepayers in Manchester knew perfectly well that the shoe was beginning to pinch very considerably. If a reduction was to be made, he suggested that it should be in the form of a discount to those who paid their accounts at the Town Hall direct.

Mr. Hampson said the Council recently passed a resolution with regard to the supply of the electric light to the out-townships; and if the proposed reduction were carried out, gas would become a great competitor with the electric contracts that had been made with those districts. It seemed to him that the proposal was unbusinesslike.

Alderman Higginbottom, interposing, said the arrangement with regard to the electric light was that it should be supplied to the out-townships which required it at the same price as to the citizens of Manchester.

Mr. Hampson (proceeding) said he noticed that they were proposing to lower the charge for electricity to almost, if not quite, cost price; and he naturally inferred that the same thing would occur in the case of gas. He objected to putting one great industry in competition with another. The argument of the Chairman of the Gas Committee seemed to be that the reduction of two years ago had been the great cause of the present increased consumption in Manchester. His (Mr. Hampson's) contention was that it had had nothing to do with it. They could not compel people to burn gas when they did not require it simply because there was a difference of 3d. per 1000 cubic feet in the price. One cause of the increased consumption which should be taken into account was the remarkably high price of paraffin oil compared with what it was a few years ago; and another was the adoption of the penny-in-the-slot system. The extension of the use of gas to distant suburbs would, he submitted, augment the already large percentage of leakage, and would also increase the cost of collection, repairs to mains, &c. Many of the people who resided in the out-townships no doubt earned their living in the city, and were entitled to some consideration. At the same time, he did not think the Council should supply gas, on which they were entitled to make some profit, for less than those townships could supply it for themselves. It was most undesirable, in face of the existing high rates, that they should do anything to further harass and impoverish the ratepayers of Manchester. He moved, as an amendment, that the matter be referred back for further consideration, and that it be brought up this time twelve months.

Mr. Pollitt seconded the amendment. He said he did not consider that the residents of the out-townships should be accorded advantages at the expense of the ratepayers of the city. The splendid plant the Committee possessed had been provided at the cost of the ratepayers; and if there were advantages to be conferred, they should be given to the citizens, and not to those who shared none of the responsibility.

Mr. Sutton urged that consumers who had adopted the penny-in-the-slot system should have the advantage of any reduction that could be made, by an increase in the quantity of gas delivered for a penny.

Alderman Lloyd said he wished to understand what would be the effect on the revenue for the year if the proposals of the Committee were carried into effect.

Alderman Gibson said about £6000. The gross amount, as it affected the revenue, was £10,250; but inasmuch as the proposals would not take effect until September, there was only half a year in which the revenue would be affected.

Mr. Cary pointed out, in supporting the resolution, that, if the Corporation had now to apply for powers to supply the out-townships, they would have to conform to the provision that they should not charge a higher price than would bring in a return of 5 per cent. The charge, therefore, would in that case be considerably reduced.

Alderman Gibson, in reply, assured Mr. Sutton that the question of the users of automatic meters had been carefully discussed by the Committee for some time. Personally, he thought the time was fast coming when, instead of giving people 25 cubic feet of gas for 1d., they would give them 35 cubic feet. He believed this was also the opinion of most of the members of the Committee. He might tell Mr. Sutton that the Committee were as much interested as himself in the matter, and that they desired to do the best they could for the poorer classes of the community. He trusted members of the Council would have sufficient confidence in the Committee to believe that they would take the step Mr. Sutton desired at the earliest possible moment. He could not tell him when it would be done; and he would not attempt to do so. He would do it as soon as ever he could.

A division then took place, when the motion was defeated by 34 votes to 31.

Alderman Higginbottom asked if he might move, as an amendment, that the price of gas to the out-townships should be 2s. 6d. per 1000 cubic feet, and that meter-rents should remain in force.

The Lord Mayor said he was informed by the Town Clerk that it would be out of order to move such an amendment.

Mr. Batty moved an amendment to the effect that the recommendation be referred back to the Committee for three months; expressing the hope that they would take into account the desire which had been expressed that some reduction should be made to users of prepayment meters.

Sir B. Leech seconded the amendment.

Alderman Gibson said if the other members of the Committee were willing to compromise the matter by accepting the amendment, he had himself no objection to doing so. He could assure the Council that the question of prepayment meter consumers had already been carefully considered by the Committee, and would be again. But it must be kept in mind that it would not be an easy matter to alter all these meters. The Committee sent out 15,000 of them last year; and all the indexes would have to be altered if a change were made in the charge.

After some further remarks, the amendment was carried on a division.

Mr. Andrews thereupon moved a further amendment reducing the period to one month.

Alderman Hoy seconded the amendment.

Mr. J. H. Wells said it would be satisfactory to him, as representing a working-class constituency, if the Committee would give 35 cubic feet of gas for 1d., instead of 25 cubic feet as at present. If the Committee had anything to give away, the prepayment meter consumers in the city had the first claim.

Alderman Gibson said he should be very glad to make a report to the Council on this matter. What he objected to was the proposal to bind the Committee down to a fixed time.

The amendment was adopted.

Alderman Higginbottom then moved the adoption of the report of the Electricity Committee, which stated that the number of consumers at the close of the year ending March 31 was 1581; being an increase of 433 as compared with the previous year. The total number of lamps (of 8-candle power) connected was 120,142, and of arc lamps 1172, as compared with 89,294 and 806 respectively in the previous year. There were also in use 122 motors, representing 217-horse power, showing an increase over the previous year of 75 motors. The total quantity of current measured and accounted for was 2,775,107 units, or 91·64 per cent. of the quantity generated. The net profit amounted to £16,812. With the balance from last year's account, the surplus amounted to £17,965, of which £10,000 had been paid to the city fund in aid of rates; the remainder being placed to the reserve fund. The Alderman remarked that the past year had been a more successful one than had been anticipated. Two years ago they held the record for producing electricity at the lowest works' cost and the lowest total cost. Last year they lost the record—Leeds and Edinburgh going slightly below them. But this year, he was glad to say, they had regained it.

Mr. J. Phythian seconded the motion, which was adopted.

Alderman Higginbottom next moved that the price of the electric current be reduced from 6d. to 5d. per unit, and the fixed charge to long-hour consumers from £9 to £7 per annum per unit of demand, *plus* the present charge of 1½d. per unit, as measured by meter; such reductions to take effect from the 29th of September. The cost of this reduction, he said, would be £7653. The Committee had again exceeded the limit of profit they were allowed by Parliament to make. Last year they had a gross profit of £20,000, and they reduced the price by 2d.; the result being a gross profit this year of £16,000. They had already put to the contingent and renewal funds the sum of £27,000.

The motion was adopted.

THE CONDITIONS OF LABOUR AT THE STOCKPORT GAS-WORKS.

The Gas Committee of the Stockport Corporation have adopted a new arrangement as to wages and conditions of work for their employees. Briefly summarized, it comprises that stokers shall work in shifts of eight hours, and that no man in the carbonizing department shall be expected to do more than his proper stint except under temporary conditions. Each stoker shall carbonize 3 tons 5 cwt., at the rate of 5s. per shift, or when working by himself 2 tons 5 cwt., including wheeling in and out, and where, in case of absolute necessity, extra weight is carbonized, such weight shall be paid for *pro ratâ* to the ordinary rate. If a stoker is stopped after having done one, two, or three rounds, he is to be paid his full wages of 5s., conditional upon his finishing the shift at any work which he may be called upon to do. Stokers who duly present themselves for work, and are prevented from starting, shall be paid 1s. 3d., unless they have been informed, prior to setting out, that their services were not required. Stokers engaged for the regular winter season with fourteen days' notice on either side, shall be found work in the yard if there should be a temporary stoppage of the retorts. All Sunday work by the retort men is to be paid for at the rate of time-and-a-half. Good Friday and Christmas Day are to be paid for at double the ordinary rates, provided the men lose no time for three days before and three days after. Men who are not ordered to work on Good Friday or Christmas Day are to be paid a day's wage if they have fulfilled the condition just mentioned of losing no time three days before and three days after Christmas Day or Good Friday. All carbonizing men regularly employed in the retort-house are to be annually allowed a week's holiday, with 25s. pay for stokers and firemen, and 20s. for charge wheelers. All labourers, whether employed inside or outside the works, are to be paid not less than 4½d., and not more than 5½d., per hour a week of 53 hours, with time-and-a-half for all Sunday work, and time-and-a-quarter for any other overtime; any overtime to be reckoned only after the full 53 hours have been made. Regular labourers will be allowed a holiday on Good Friday, Christmas Day, and two days at Cheadle Wakes.

THE PROPOSED SUPPLY OF WATER GAS IN MANCHESTER.

Deputation to the Gas Committee.

A deputation from the Manchester and Salford Sanitary Association waited upon the Gas Committee of the Manchester City Council last Friday, for the purpose of "urging the necessity for obviating the dangers which would most certainly arise, were water gas introduced into the Manchester gas supply." Alderman GIBSON, the Chairman of the Committee, presided.

A memorial from the Association stated that they viewed with much concern the growing practice of municipal gas committees in using water gas as an ingredient in the composition of gas for illuminating purposes. Ordinary coal gas was poisonous when respired; its poisonous property being due to the presence of carbon monoxide, which exists naturally in coal gas in the proportion of from 4 to 8 per cent. Water gas contains 40 to 45 per cent. of carbon monoxide; and when used to mix with coal gas or with oil gas, the percentage of carbon monoxide in the illuminating gas thus composed was raised from 4 to 8 per cent. to not less than 18 or 20 per cent—in other words the poisonous property of gas thus constituted was increased to at least three-fold of that of ordinary gas. Carbon monoxide poisoned people by combining with the principal component of blood; and in so doing rendered the blood unfitted to perform its chief function of conveying oxygen from the lungs to the various parts of the body. If oxygen was not so conveyed, the individual whose blood was thus incapacitated died of suffocation just as surely as though he were strangled by a cord round the neck. A person might be fatally poisoned even by a small proportion (as small as 0·5 per cent.) of the gas in air which was respired for some time. Carbon monoxide was odourless; and when mixed with coal or oil gas, would diminish the odour of either gas to such an extent that a small accidental escape would fatally poison anyone who breathed it (as in the case of a person sleeping in a bedroom) for several consecutive hours.

Dr. DIXON MANN, Professor at Owens College, explained the views of the deputation concerning the dangers of carbon monoxide. The danger, he said, arose from the fact that quantities of it were progressively taken up every minute the gas was breathed, until at last a suffocating point was reached. Then the person became unconscious, and would shortly die unless restorative means were applied. Although they laid great stress on the point of acute poisoning, they did not, however, limit their objections to immediately fatal results, because they were convinced there were great evils which would result from the breathing of infinitesimal percentages of the gas mixed with the air, that would not produce death, but what was called chronic poisoning. All were aware of the dangers attributed to chronic lead-poisoning, and an analogous state of things would occur from carbon monoxide, which constituted some 30 or more per cent. of water gas. Where there was an escape of ordinary coal gas, it might be inhaled for an almost indefinite period without producing evil effects; but if the poisonous qualities of the gas were increased, as would be the case by water gas, a very considerable amount of harm would accrue. It was quite a common experience to hear of leakages of gas in houses for two or three days before they were attended to. With coal gas these leakages might be harmless; but with water gas the reverse would be the case. The question was a very important one; and the points he had drawn attention to ought to have weight with all authorities who purposed introducing water gas.

Mr. WILLIAM THOMSON added that what the deputation wished particularly to point out was the risk of leakage; and if the Gas Committee would do what lay in their power to prevent minute leakages which occurred in a great many houses, and also warn the people that leakages must be attended to immediately, he thought the wishes of the deputation would be met.

The CHAIRMAN said that personally and on behalf of the Committee he desired to thank the deputation for their visit. It was a pleasure to find the citizens taking an intelligent interest in such an important public matter as the gas supply; and they heartily welcomed all just and fair criticism. He first of all wished to assure them and the public that the Committee had not approached the question of the manufacture of carburetted water gas without obtaining a perfect knowledge of the business they were proposing to undertake, and without a full sense of their responsibility. Why did they want the water-oil gas at all? Firstly they wanted it simply as an auxiliary. They had never in Manchester had storage capacity for a day's production of gas until this year, when they put down a very large holder at the Bradford Road works with a capacity of 7 million cubic feet. But a day's holding power was not a very great deal when they came to consider that they were consuming something like 23 or 24 million cubic feet of gas per day. During the foggy weather of last year and the year before, they were within twenty minutes, or half an hour at the utmost, of leaving the city in absolute darkness, which would have been a very serious matter for the Committee. The carburetted water gas could be made so readily that it was almost like turning on a tap and the gas was awaiting consumption. In one day they could produce as much of this as would take four or five days by means of the coal-gas plant. That was one reason why they thought of making water-oil gas. The Committee had satisfied themselves absolutely as to the usefulness and practicability of the gas, after watching experiments and making themselves thoroughly acquainted with the experience of others. The water-oil gas had been in use in London for nine years, and had occasioned the authorities no trouble. After visiting the Metropolis, the members of the Committee proceeded to Belfast, where a complete plant had been laid down for the supply of water-oil gas; and afterwards to Dublin and Liverpool. Water-oil gas had as pungent and strong an odour as coal gas. They had also visited Birmingham, Edinburgh, Blackburn, Stockport, and other places where the water-oil gas was used; and they learned that not one single case of poisoning had occurred other than would have taken place had it been ordinary coal gas. Having referred to the supply of carburetted water gas in America, Alderman Gibson said that, roughly speaking, ordinary coal gas contained about 8 per cent. of carbonic acid, and carburetted water gas about 25 per cent. What the Committee proposed to do was, whenever the necessity arose, to mix 25 per cent. of water-oil gas with 75 per cent. of ordinary coal gas. By this means, they would obtain a higher illuminating power, and without incurring under proper control any more danger than existed at the present time. Leakage was, as Mr. Thomson had urged, a very important matter, and recognizing this, the Committee had already appointed a special Sub-Committee whose sole business it was to watch for leakages in gas-pipes all over the city. In addition to this, notices had been distributed requesting the public to communicate with the Committee immediately an escape of gas was discovered, and giving them instructions what precautions should be taken to eliminate any possibility of danger meanwhile. He wished it to be thoroughly understood that the Committee had not approached the matter thoughtlessly and carelessly, nor from a pecuniary point of view; but solely from a desire to do what they could to promote the best interests of the community.

The deputation thanked the Chairman and Committee for their courteous reception.

RAMSGATE CORPORATION GAS AND WATER SUPPLY.

The Annual Accounts.

The accounts of the Gas and Water Departments of the Ramsgate Corporation for the year ending March 31 were presented to the Committee on Monday last week, accompanied by a report by the Chairman, Mr. C. J. Gwyn, the ex-Mayor.

With regard to the gas undertaking, the expenditure on capital account in the twelve months amounted to £3938, of which £2059 was for land, £785 for new buildings and plant, £863 for new mains, and £231 for new meters. The principal portion of the latter were for prepayment consumers, who now form an important section of the customers of the Gas Department. The Chairman points out the gratifying fact that this system of gas supply was first introduced at Ramsgate; and the total number of inhabitants taking their supply in this way at the end of March was 1187—the average consumption per head being 13,688 cubic feet. The total amount expended on account of gas-fittings for these consumers has been £3191, or an average of £2 15s. 6d. per house. This outlay is treated as a suspense account; and already there has been written off £2012, which leaves a balance of £1179. As to the gas-stoves fixed on hire, their gross value is £3725. This is similarly treated; and there has been written off £1734 – leaving a balance of £199. It will thus be seen that the capital account is not loaded up as it might be with the cost of fittings and stoves. These are made self-supporting, while at the same time they are a source of considerable revenue. The above-mentioned expenditure on capital account increased the overspent balance to £5922. Application has been made to the Local Government Board for a Provisional Order; and as soon as this is obtained, steps will be taken to clear off the balance, and raise money for erecting a new gasholder, retort-house, &c., which have been rendered necessary by the increased demand for gas. The revenue account shows that the sale of gas for public and private lighting produced £22,933; rental of meters, £805; and residuals, £4471—the total being £28,292. The revenue from the sale of gas is £2221 higher, and that from the sale of residuals £1220 lower, than in the preceding year. Apart from the depression in the residuals market, the quantity of sulphate of ammonia made suffered from the inadequacy of the washing and scrubbing plant to deal with the increased make of gas. The Engineer (Mr. W. A. Valon, J.P.) reports that for many weeks during the period of the highest consumption, he was compelled to allow the gas to bye-pass without undergoing the process of washing and scrubbing. The expenditure on revenue account amounted to £20,814, of which £16,822 was for the manufacture of gas; £11,165 being for coals. This is £587 more than in the year 1895-6, due to the larger quantity required to produce the additional bulk of gas. The lighting and repairing of the public lamps cost £906; being £215 more than before. This is principally due to the arrangement by which the Committee and the Council agreed to the re-fitting of the whole of the lamps throughout the town with incandescent burners. Management expenses were less, and so were bad debts; and though the total expenditure was more than in 1895-6, the amount spent per ton of coal carbonized was lower. The balance carried to the profit and loss account is £7477. During the past year £1552 was added to the general district fund; and a sum of £1425 was paid off the capital account. These amounts, with the income-tax and dividend, came to £4993; leaving the balance of net profit £2484, or an increase of £932. The reserve fund account now stands at £4902. The working account shows that 15,470 tons of coal were carbonized; being 600 tons more than in 1895-6. The residuals produced were: Coke, 9282 tons; tar, 129,090 gallons; and sulphate of ammonia, 72 tons 6¼ cwt. While the same proportionate quantity of coke was made per ton of coal, the percentage used for fuel was considerably less than in the previous year—2078 tons, as against 2197 tons. The quantity of gas made was 182,590,000 cubic feet, as compared with 163,096,000 cubic feet in 1895-6—an increase of nearly 20 millions. The total number of consumers is now 3577.

The capital account of the Water Department was raised last year from £114,345 to £126,145 by the issue of more 3 per cent. stock. There was an expenditure of £5631 on reservoirs, wells, &c.; and of £417 on mains and service-pipes. The balance of unexpended capital at the close of the year was £6274. The receipts on revenue account amounted to £10,000, an increase of £367; the expenditure, to £4339, of which £3878 was for maintenance. The balance carried to the profit and loss account is £5661. The balance of profit from last year, amounting to £1428, was paid over to the district fund. The loan charges, including £1150 paid off capital, amounted to £4368. This deducted from the gross profit left a net profit of £1293, or £75 more than before. The reserve fund has been increased, by the amount of the interest, from £3947 to £4048.

The two departments last year produced a sum of £3777 as net profit; the amount contributed to the relief of the rates having been £2980.

The report having been adopted, a vote of thanks was unanimously accorded to the ex-Mayor for his services as Chairman of the Gas and Water Committee.

The EX-MAYOR, in acknowledging the compliment, said he should have preferred the vote of thanks to have been given to Mr. Valon, their

Engineer, because to his constant attention to the work, and to his ability in carrying it out, was due the result which he, as Chairman, had been able to lay before them. If they would allow him, he should like to propose a vote of thanks to the Engineer for the capital results he had not only produced this year but in previous years.

Alderman BLACKBURN seconded the proposition.

Mr. VALON, in returning thanks, acknowledged the assistance he received from the officers and men, without which he could not, he said, give the satisfaction he was able to do with their support. He was also indebted to the Chairman for his earnest attention. He was always ready to bring his judgment and keen sense upon anything he (the Engineer) had to submit to him.

BATLEY CORPORATION GAS SUPPLY.

The Annual Accounts.

According to the accounts of the gas undertaking of the Batley Corporation for the year ending March 31, as certified by the Borough Accountant (Mr. T. Cantrill), the sale of gas produced £15,552; meter and stove rentals, £748; and residuals, £3392—the total revenue being £19,717. In the manufacture of gas a sum of £8571 was expended—£5528 being for coals and £2085 for wages; distribution cost £647; rates and taxes amounted to £1747; and general management, to £612—the total expenditure being £11,486. The balance was therefore £8231. After payment of interest and the usual instalment of the sinking fund, there was left a balance of £2388. This added to the profit accumulated to March 31, 1896, made a total of £9123, out of which, as already mentioned in the "JOURNAL," £2000 was transferred in aid of the borough rates, and £383 added to the contingency fund—leaving £6734. The latter fund had a balance of £7663 on the above-named date; and a sum of £5117 was taken to defray the cost of eight arches of eight inclined retorts. The works, which are under the supervision of Mr. J. F. Bromley, carbonized 14,478 tons of coal and cannel; the quantity of gas made being 142,195,000 cubic feet. Of this amount 139,579,000 cubic feet were sold, and 956,000 cubic feet used on the works—a total of 140,535,000 cubic feet accounted for. The leakage is exceptionally low; being only 1·167 per cent. The capital charges work out to 10·47d., and rates and taxes to 3d. per 1000 cubic feet of gas sold. The net charge for gas in Batley is 2s. 3d. to private consumers and 1s. 6d. for the public lamps; and in Soothill, 2s. 6d. for both purposes. The consumers by prepayment meters are charged 3s. 4d. The average price all over the district is 2s. 2d. per 1000 cubic feet.

SALES OF STOCKS AND SHARES.

On Monday last week, Mr. Alfred Richards sold at the Mart, Tokenhouse Yard, £15,000 of 4 per cent. perpetual debenture stock of the Tottenham and Edmonton Gas Company, at prices ranging from £120 to £126 per £100 of stock. On the following day, he conducted a sale of stocks and shares in various gas and water companies. A new issue of £5000 of ordinary 5 per cent. stock of the Guildford Gas Company was put up in 35 lots of £100, and 30 lots of £50 each. The stock was disposed of at prices ranging from £123 5s. to £125 per £100, with dividend as from the 1st inst. Some new ordinary 5 per cent. stock of the New Swindon Gas Company was sold for £122 10s. and £123 10s. per cent., with the dividend as from May 22. A parcel of 4½ per cent. perpetual debenture stock of the Commercial Gas Company was knocked down at £154 per £100, *cum div.* as from the 1st inst. A few lots of £100 of The Gaslight and Coke Company's "A" ordinary stock, the last dividend on which was at the rate of 12¾ per cent. per annum, were sold for £320 each, with the dividend accruing from the 1st of January. A £10 original share in the Uxbridge and Hillingdon Gas Company was purchased for £23; a £10 share of 1861 (7½ per cent.), for £18 5s.; and eight £10 shares of 1873 (7 per cent.), for £16 10s. each. Five £10 mortgage debentures of the Maldon Gaslight Company, Limited, bearing interest at 5 per cent., were sold for £10 12s. 6d. each; nine "A" shares of £27 each in the Company, the last dividend on which was at the rate of 7½ per cent., for £48 each; and some £9 "B" shares, for £15 10s. apiece. Some £5 "B" shares in the Ilford Gaslight and Coke Company, Limited, the last dividend on which was at the rate of 8 per cent. per annum, were knocked down at £10 7s. 6d. each. A few fully paid 6 per cent. preference shares in the Aldershot Gas and Water Company were sold at £17 and £17 5s. per share; and some 5 per cent. preference shares of similar nominal value, at £14 10s. each. A few lots of £50 "C" shares in the Portsea Island Gas Company, on which 12 per cent. is being paid, were sold for £144 apiece, *cum div.* as from Jan. 1 last.

The Costs of the St. Anne's Gas Bill.—At the meeting of the St. Anne's District Council last Wednesday, the minutes of the Parliamentary Committee stated that the Clerk had reported that, though the Gas Bill had successfully passed the House of Lords, the Commons Committee had thought fit to throw it out. Consequently, unless some arrangement could be made with the Local Government Board to grant a loan for a term of years, the costs would have to come out of one year's rate. The members of the Joint Authorities' Committee, with the Clerk, were deputed to wait upon the Local Government Board, place the whole facts before them, and make the best possible arrangements.

Extension of the Arrol-Foulis Stoking Machinery at the Birmingham Gas-Works.—The Arrol-Foulis stoking machinery has been in constant operation at Birmingham for the last six years; the first installation having been from time to time augmented until at present more than a dozen machines are at work. Such satisfactory results have been obtained from this system of stoking, that the Corporation have now decided, on the recommendation of Mr. Charles Hunt, M.Inst.C.E., the Engineer of their Windsor Street works, to still further increase the plant now in operation; and they have consequently placed with Sir William Arrol and Co., Limited, an order for two additional charging-machines and two drawing-machines.

GAS v. ELECTRICITY FOR PUBLIC LIGHTING AT EXETER.

A Triumph for Gas.

The fact that the proposal to light some of the streets of Exeter by electricity necessitates a reconsideration of the contract with the Gas Company, has given the opportunity for an interesting discussion on the merits of the two systems of street illumination. Reference has already been made in the "JOURNAL" to the proposals of the Corporation, and to some of the letters which Mr. W. A. Padfield, the Secretary and Manager of the Company, has written to the Corporation on the subject. The matter came before the City Council again last Wednesday, when another letter from Mr. Padfield was read. He stated that the Directors had considered the suggestions of the Corporation respecting the question of street lighting, and were willing to enter into a new contract, subject to the following conditions: (1) The term to be for seven years, determinable by either party upon six months' previous notice. (2) The Council to pay the cost of removing and fitting up the whole of the lamps not required in the electric lighting area. (3) The Council to pay the additional expense of extinguishing the "Westminster" and 12-feet lamps at midnight, in consequence of their distribution over a larger area. Mr. Padfield went on to allude to the proposals of the Corporation with reference to the electric lighting of some of the streets. It was reported that the Electric Lighting Committee had been authorized to spend £1650 for the installation of the electric light. He found that 33 Denayrouze high-power 5-light cluster burners, with the necessary standards and lanterns, would come to £956 3s. 6d.; and the supply of gas, mantles, and the cost of maintenance for twelve months would be £663 14s. 3d.—making a total of £1619 17s. 9d. In other words, the Gas Company could supply new gas plant of equal lighting power to the electric light, and make the Council a present of the first year's gas, for a smaller sum than they were going to spend on the installation of the electric light, without reference to the cost of the light itself. He found no indication in the report of the Electric Light Committee of the probable annual expense of the light; and it would not surprise him if, after taking all the outlay into consideration, including depreciation and interest on capital, it worked out at three times the cost of gas. Taking electricity at 6d. per unit, there was an enormous advantage in using the Denayrouze burner; the gas at 2s. 10d. per 1000 cubic feet working out practically at about 1½d. per unit. As the Exeter Gas Company were supplying gas at 2s. 6d. per 1000 cubic feet, the comparison would be still more in favour of gas. In many instances, these burners were taking the place of the electric light. Looking at the question from a ratepayer's point of view, in which the Gas Company were deeply interested, it might be worth while for the Council to give the matter further consideration.

The TOWN CLERK (Mr. G. R. Shorto) said the Council had approved of the first condition, with the exception that they thought the term should be seven years, determinable at three, five, or seven years. The three years was objected to by the Company.

Alderman DOMVILLE moved that the Council give general approval to the conditions of the contract suggested by the Gas Company, and refer the remainder of the letter to the Lighting Committee to settle the details. He congratulated the Company upon the improved character of the lighting in many parts of the city, and expressed the hope that they would extend this benefit to the general consumers.

Mr. WREFORD said it was desirable that this matter should be settled forthwith. The Council might very well agree to abandon the restriction they proposed with regard to giving notice at the end of three years to terminate the contract, in favour of five years. He suggested that the Council should deal with the matter that day.

Alderman DOMVILLE thought it desirable that they should have a little more time, for there were several points to be considered with the Company. If they gave a general approval of the contract, they would be working very amicably with the Company.

Mr. VARWELL remarked that Mr. Padfield was a gentleman of considerable eminence in his profession, and from his statements it appeared that the city was going to pay three times as much for the electric light as for the gas supply. He did not know whether or not these statements could be controverted; but as yet they had no official estimate of the cost to the Council of the electric light. They were running into a heavy expenditure; and if they were committed to it without having had a proper estimate, it would be a serious thing.

The TOWN CLERK said Mr. Padfield's statements were based upon an hypothesis which was not well founded. At all events, the Council had decided to light the main streets with electricity; and until they rescinded this resolution, they could not discuss any other means of illumination.

The CITY SURVEYOR (Mr. D. Cameron), stated that the cost of the electric light worked out at the price mentioned by Mr. Padfield—viz., 6d. per unit; but there would not be the difference he suggested.

Mr. WREFORD moved, as an amendment, that the Town Council agree to the contract with the Gas Company for seven years, determinable at five years.

Alderman DOMVILLE thought it would be better to give a general approval to the terms of the contract, and leave the details to the Committee.

Mr. WREFORD said that general approval would not advance negotiations.

The amendment was, however, rejected.

Mr. VARWELL said he should like the whole of the letter to be referred to the Lighting Committee, in order that they might give the Council a proper reply to it. He thought the citizens generally would wish to know exactly where they were in the matter. He had no objection to the city being lighted with electricity, even if they paid a trifle larger amount for it. They had never received from the Electric Lighting Committee any statement as to what they proposed to do.

The TOWN CLERK ruled that it would be out of order to discuss the question of lighting the central streets with gas until they had rescinded the previous resolution as to the electric light.

Alderman DEPREE stated that the Electric Lighting Committee had already discussed the question as to the comparison of the costs. How was it possible for them to give any comparison until they had thoroughly formulated their scheme? The Committee were dealing fully with the

matter. When the details were in hand, they would be in a position to furnish a comparative statement.

Alderman Domville's resolution was then agreed to.

The Electric Lighting Committee recommended the acceptance of tenders for arc lamp posts, &c., and that tenders be obtained for the supply of the arc lamps.

Alderman Domville moved the adoption of the report, and said that the cost of the lamps and fittings and their erection would amount to about £1650. The primary reason for lighting the proposed area with arc lights was because, at the present moment, the machinery they had could quite easily run the whole of the arc lamps without any additional expense. All they would have to do would be to transfer the portion of the light which was now supplied to private customers to the incandescent circuit. In the course of a year or two they would be able to bring up to the Council a report as to the actual cost of the working. At present, if they chose to take advantage of the Council, they could say it cost nothing, because the power was already at work; but it was proposed to charge the Council £20 per lamp per annum. This would amount to a total cost for arc lamps of £660 a year. The cost for gas was now £500; so that the increased outlay for electric lighting was £160 per annum. He hoped the advantages given by the better light would be sufficient compensation to the citizens. At the same time, it was fair to say that the lamps suggested by the gifted Engineer of the Gas Company were extremely good; and the Committee were obliged to the Company for the way in which they had supplied them at various places in the city. He was glad to know they had an opportunity of having them at other points of large traffic; but if the 33 new lamps suggested by the Company's Engineer were supplied instead of the electric light, they would cost £663 14s., or a little more than electricity. The six months that had passed since the Council had charge of the electric light undertaking had resulted in a very considerable profit. So far as he was personally concerned, the contract submitted by the Gas Company and the terms agreed upon were very satisfactory; and it would be wise for the Council to accept the terms as to the length of period of the contract.

Mr. Dunn, who had given notice to move the rescinding of the resolution as to electric lighting, said that after the statement of Alderman Domville he would not proceed with his motion.

ELECTRIC LIGHTING NOTES.

The Burnley Town Council have resolved to make application to the Local Government Board for sanction to a loan of £2000, required for the purpose of extending the electricity distribution system.

In reference to the proposal that the Sheffield Corporation should acquire the Electric Lighting Company's undertaking, the following resolution has been unanimously passed by the Parliamentary Committee: "That further negotiations with the Sheffield Electric Light and Power Company be suspended until it is ascertained, by legal decision upon the action already commenced, what really is the position of the Corporation in the matter."

The Eccles Town Council have long been fluttering round the electric light; and the result is seen in a resolution passed at their meeting yesterday week. It was that application be made to the Local Government Board for sanction to the borrowing of £1565 12s. 6d. to defray the expenditure of the late Local Board and the Council in connection with the proposed electric lighting of the borough. The sum has been spent entirely on preliminary matters; and for the purpose it appears heavy. It represents Provisional Orders, advice from consulting engineers, inquiries by deputations, and chief rent on plots of land purchased. It is to be hoped that the knowledge gained justifies the expenditure.

The St. Pancras Electric Lighting Committee are evidently getting fearful of their financial position, for they state that, in view of the advantage resulting from knowing the present financial condition of their department, they have had under consideration the question of the preparation of an interim balance-sheet and trading account as on June 30. The Committee are unanimous in the opinion that it is "eminently desirable that this information should be prepared;" and they recommended accordingly. The Vestry concurred *nem. con.* Under these circumstances, it is not surprising to find that the report of the Chief Electrical Engineer (Mr. S. W. Baynes) on the proposed extension to Highgate is far from enthusiastic. Indeed, this official, while estimating the cost at considerably more than £5000, is of opinion that there does not appear to be sufficient inducement to encourage the Committee in taking in hand this extension in its modified form. He therefore advises that it should be deferred until the department is in a position to be "better able to sustain the losses which would result therefrom." As the loss appears to be about £196 for the first year only, the Committee are to be commended for supporting their Engineer. They express the opinion that, "in view of the deficit on the past year's trading, and the further loss foreshadowed if the present scheme be carried out," the matter should be adjourned. This has been done, for two months, by which time the promised financial statement should be ready. These little matters, however, do not stay the Vestry's hand from borrowing more money; and at their last meeting it was decided to apply to the London County Council for a loan of £13,135 in respect of expenditure for the Regent's Park station account, and of £10,486 for the King's Road station; both loans to be repayable in 42 years by equal half-yearly instalments of principal and interest.

The Electric Lighting Committee of the Dublin City Council have prepared a report dealing with the financial results of the working of the electric-lighting system for 1896. The statement of the City Accountant shows that the gross income for the year was £11,747; and the expenditure (not including interest on the loan) amounted to £8991; leaving a surplus of revenue over expenditure of £2756, which is equivalent to 4·7 per cent. on the capital expenditure to the end of the year—viz., £58,030. This surplus was applied to the payment of 3½ per cent. interest on the loans obtained for the erection of electric-lighting plant; and for this purpose £1073 was required. A sum of £81 was written off the assets shown in the accounts for 1895; leaving a balance of £1073. The amount required for the repayment of loans was £2213 for last year; and the balance of the surplus—£1073 – having been applied to that purpose, it would appear there was really a deficit on the year's working of £1139 to be discharged out of the rates. This deficit is provided for by the special rates raised for electric lighting purposes in 1891 and 1892, amounting to £6636. This fund, however, is becoming rapidly exhausted; while the demands upon it do not appear to be diminishing in any appreciable degree. In a report by the Electric Lighting Superintendent, it is stated that alterations in the system are "absolutely necessary," and that they will involve "heavy expense," so that the citizens may look forward in the estimates this year to a considerable call upon them for electric lighting. It is right, however, to point out that the Committee have done a great deal in the way of repaying the loans obtained for the purpose of establishing the system. Up to Dec. 31 last, the total amount of loans repaid was £7893; the amount paid on interest on loans, £6078; the amount transferred to the depreciation account, £1000—making a total of £14,971. The amount so far paid out of the rates comes to £5270; so that the sum paid out of income is £9700.

Last Thursday, the Hampstead Lighting Committee brought up their report on an instruction given in April, "to report upon the cost of lighting the streets with incandescent gas-lamps, for the purpose of comparison with any report they may make in pursuance of the resolution of the 18th of March, 1897, in regard to incandescent electric lighting." They stated that they had fully considered the very exhaustive report on this subject by Mr. T. H. Nisbett, the Town Clerk of Douglas, Isle of Man, and, as such report dealt very fully with the matter, they had given instructions for each member of the Vestry to be furnished with a copy. They had also had before them the reports of their own Surveyor and Engineer, from which the conclusions were that the annual cost of gas-lamps with 4-feet ordinary burners would be £2 14s. 2d. per lamp, and £3 4s. 11d. with 3-feet incandescent burners; while incandescent electric lamps of 11-candle power would cost £2 13s., and those of 16-candle power £3 5s. 6d. each per annum. It was stated that a 4-feet gas-burner was equal to 10·8-candle power; and a 6-feet burner, to 16-candle power. These figures, it will be noted, make gas the more expensive illuminant; and the Committee therefore recommended—"That the question of lighting the streets with incandescent gas-lamps be not further considered." This was agreed to. After some discussion, in the course of which Mr. Hackworth and Mr. Colley spoke against the adoption of incandescent electric lighting—the latter gentleman expressing his dissatisfaction with the result at Brighton, where, in his opinion, the effect was not equal to that of the ordinary gas-lamps at Hampstead—the Vestry decided "That a trial be made of the incandescent electric street lighting, and that the Committee report to the Vestry the result after of a three months' experiment." This was agreed to. It is regrettable that no member of the Vestry was sufficiently practical to be able to challenge the accuracy of the above figures, which is surely questionable. Later in the evening, some excitement was caused over the action of Sir H. Harben, the Chairman of the Vestry, while the question of the compensation to be given the widow of the workman killed at the electric lighting station was being discussed. The Committee recommended—"That, without in any way admitting the liability of the Vestry, and entirely without prejudice, the sum of £200 be offered to the widow of H. White, deceased, as compensation for the loss sustained by her in the death of her husband; such sum to cover all costs and all claims (if any) whatsoever which she or the representatives of the said H. White may have against the Vestry in respect of the fatal accident above mentioned." Mr. Haubart inquired whether the Vestry or the Vulcan Boiler and General Insurance Company were to pay this money; but the Vestry Clerk, "as a lawyer," requested Mr. Haubart not to put that question. A voice from the public gallery pertinently inquired, "Why not?" whereupon Sir Henry ordered both the representatives of the Press and the public to leave the room.

Price of Gas for Power Purposes at West Bromwich.—The West Bromwich Town Council last Wednesday accepted a recommendation of the Gas Committee that the following scale of charges for gas be adopted from Oct. 1: 1,000,000 cubic feet and upwards per quarter, 1s. 6d. per 1000 feet net; 500,000 to 1,000,000 feet per quarter, 1s. 9d.; 200,000 to 500,000 feet per quarter, 2s.; less than 200,000 feet per quarter, 2s. 2d.

St. Ives (Cornwall) Water Supply.—An inquiry was held at St. Ives, Cornwall, last Tuesday, by Major-General Crozier, R.E., and Mr. E. P. Burd, on behalf of the Local Government Board, respecting an application by the Corporation for power to purchase the water-works, and to borrow £4000 for the purpose. The Town Clerk (Mr. E. Boase) explained that the St. Ives Water Trust was constituted by deed in 1866, and since then the water-works had been managed by a body of gentlemen appointed by the Corporation, but acting as a separate body. They had expended nearly £7000, and had acquired works which gave the town a very efficient supply of water. In order to do so, they borrowed money on their own land, for which they had been paying 5 per cent.; and the Corporation believed that if they acquired the undertaking, they could raise this loan at a less rate of interest. Mr. Burd said it appeared from the deed that in 1844 certain people subscribed money for the purpose of water supply. The property was transferred by deed in 1866, so that the amount should not go to the borough fund. It was a curious situation. The Town Clerk said the Corporation were anxious to have the matter put right; and the only alternatives seemed to be either an application to borrow money for the purchase of the property from the Water Trustees, or a loan to pay off the existing liabilities, which included £3698 due to the bank. As the Corporation did not hold themselves responsible for the debt, they did not suggest that the second course should be taken. Mr. Burd pointed out that the Local Government Board could not go behind the deed, and authorize a conveyance to the Corporation, as there was no power in the deed to convey. The Town Clerk said if there was no alternative, they must get an Act of Parliament; but they wished to avoid this expense if possible. Since the deed of 1866, nearly all the properties acquired had been conveyed to the Corporation, and not to the Trustees. Mr. Lees, a ratepayer, opposed the application, on the ground that Corporation properties were mismanaged. The real fact was that they had gone in for a new reservoir at the Consols mine, which was defective; and this loan was required to remedy the causes of the mismanagement, and to repay money which they had spent without the permission of the Local Government Board. Mr. Grenfell, the Borough Surveyor, said that there had been a small leak in the reservoir, but it was now perfectly tight. The Town Clerk commented on the fact that no alternative suggestion was put forward by the opponents of the Corporation's proposal.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

I have not yet received any intimation of the date of the annual meeting of the North British Association of Gas Managers, which is to be held in Ayr this year; but a Glasgow newspaper has this week announced that it is to be on Thursday, the 29th inst; with a sail on the following day by the Kyles of Bute to the head of Loch Long. It is to be hoped there will be a good attendance.

On Tuesday of this week the annual meeting of the Galashiels Gas Company was held, at which the Directors reported that the consumption of gas during the year amounted to 50,820,976 cubic feet—a decrease of 2,952,126 cubic feet on the preceding year. The Company began the year with a balance at the credit of profit and loss account of £6035; and during the twelve months a profit of £1941 was earned. A dividend at the rate of 10 per cent. was declared; and £5876 was carried forward. The price of gas has been continued at 3s. 4d. per 1000 cubic feet. The Chairman, in explanation of the decrease in the demand for gas, said it was due to depression in the business of the town. The consumption was nearly 9 million cubic feet less than in 1890, which was their record year, and represented loss of revenue to the amount of £1400. If they had been so fortunate as to sell as much gas during the past year as in 1890, they might have had a substantial balance, after paying the dividend, instead of requiring to draw to a small extent on the reserve fund, in order to keep the dividend at the old rate of 10 per cent. They had, fortunately, a reserve fund of nearly £6000; and they might hope the business would improve in the town, and that the Company would soon again resume their former condition of prosperity. The Directors had not neglected to keep the works in the highest state of efficiency. Never at any former period were they so well equipped in respect to the newest appliances and the most economical working. This had entailed extra expense under the heading of repairs and furnishings, to the amount of fully £250 during the past three years; and this extra expenditure would be continued until the end of the current financial year, in 1898. The hydraulic main had been renewed; and the retort-bench had been converted into a semi-regenerative one. They had bought coal for the current year on terms which would effect a saving of about £100; and they had purchased coal-waggons, which would obviate the necessity of their hiring waggons, and would effect a further saving of about £60. He thought they did not need to take a despondent view of their position and circumstances. Trade seemed to be, on the whole, improving; their works were in a thorough state of efficiency; they had a prospect of decreasing expenditure, with increasing sales of gas; and they could thoroughly rely on their Managers (Messrs. Scott) doing everything possible to ensure the continued success and prosperity of the undertaking. The report was adopted. I had no idea, until I read this report, that the wool trade had been so hardly hit during the past few years as it appears to have been. Galashiels I always looked upon as a thriving place; but even it seems to be having a struggle for existence. The Gas Company are practically the manufacturers of the town; and in such a state of matters the Company give a very correct reflex of the prosperity, or otherwise, of the district. What is puzzling to me is that in Hawick, where the circumstances are very similar, there was an increased output of gas last year to an extent of more than 3 million cubic feet. May not this suggest that what is wrong is not so much a depression in trade generally, as a failure on the part of Galashiels manufacturers to keep themselves abreast of the times, and so allowing trade to slip away from them? Their management of the Gas Company is all that can be desired; but if they allow the trade of the town to suffer, the fortunes of the Gas Company will soon be affected also.

The annual meeting of the Ayr Gas Company, Limited, was held on Wednesday. It was reported that the past year had been one of the most successful in the history of the Company—so much so that the Directors recommended a bonus of 2 per cent., in addition to the usual dividend of 6 per cent. The price of gas, as from Feb. 1 last, was reduced from 3s. 9d. to 3s. 4d. per 1000 cubic feet. The revenue for the year amounted to £12,571, of which £11,151 was derived from the sale of gas, £345 from meter-rents, £351 from coke, £620 from tar, and £19 from waste lime. The profit for the year amounted to £3579. During the past year £900 was transferred to the reserve fund, raising it to £4900. The Company also possess a suspense account, amounting to £263. Altogether they appear to be in a most prosperous position, for which the Manager (Mr. W. Smith) is to be congratulated.

At the annual meeting of the Carluke Gaslight Company, on Thursday of this week, it was reported that the consumption of gas during the year amounted to 6,337,400 cubic feet, which was an increase of nearly 700,000 cubic feet upon the preceding year. It has been resolved, on account of the increasing demand for gas, and the difficulty there would be in extending the existing works, to erect entirely new ones. An eligible site has been secured. The erection of the works is not intended to be begun until next year; but it is expected that they will be ready for use before the end of the summer. In view of this important step, it has been resolved to have the Company registered as a limited liability company. A dividend at the rate of 6s. per share was declared; and the price of gas was retained at 3s. 4d. per 1000 cubic feet.

The Alyth Gas Company last year had their bench of retorts converted into a regenerative system, to plans prepared by Mr. Forbes Waddell, of Forfar. The setting has been found to work so satisfactorily that the Company have been able to pay one-third of the cost in one year, and to reduce the price of gas by 5d. per 1000 cubic feet. They have also directed that a handsome honorarium be sent to Mr. Waddell, in addition to the usual fees.

The annual meeting of the Cupar (Fife) Gas Company was held on Thursday. The capital of the Company consists of 250 ordinary shares of £25 each, and 250 preference shares of £7 each. There was a profit on the year of £987; and £101 had been brought forward. Dividends at the rate of 8 per cent. on the ordinary, and 4 per cent. on the preference shares were declared; and £218 was set aside for depreciation.

The Saltcoats Gas Company had a profit on the past year's working of £917, out of which they have paid a dividend at the rate of 8½ per cent. The profits for the year amounted to £917. A year ago the dividend declared was 7½ per cent. The Pittenweem Gaslight Company have paid a dividend for the past year at the rate of 10 per cent. The

GAS AND WATER COMPANIES' STOCK AND SHARE LIST (see ante, p. 106).

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	GAS COMPANIES.			£ s. d.
590,000	10	9 Apl.	10½	Alliance & Dublin 10 p. c.	23–25	..	4 4 0
100,000	10	,,	7½	Do. 7 p. c.	17½–18½	..	4 1 1
300,000	100	1 July	5	Australian (Sydney) 5% Deb.	105–108	..	4 12 8
200,000	10	27 May	7	Belgrano (B. Ayres), Limited	9½–10	–½	7 0 0
100,000	Stck.	29 June	5	Do. 5 p. c. Deb. Stk	103–106	..	4 14 4
200,000	5	27 May	6½	Bombay, Limited	6½–7	..	4 5 9
40,000	5	,,	6½	Do. New, £4 paid	5½–5¾	..	4 10 7
380,000	Stck.	26 Feb.	12	Brentford Consolidated	298–303	+1	3 19 2
240,000	,,	,,	9	Do. New	223–228	..	3 18 7
50,000	,,	,,	5	Do. 5 p. c. Pref.	145–150	..	3 6 8
159,375	,,	11 June	4	Do. 4 p. c. Deb. Stock.	130–134	..	2 19 9
220,000	Stck.	26 Mar.	11½	Brighton & Hove Original	273–278	..	4 2 8
208,820	,,	,,	8½	Do. A Ord. Stk.	201–206	..	4 2 6
933,500	Stck.	26 Feb.	5	Bristol, 5 p.c. max.	130–135	..	3 14 1
420,000	20	26 Mar.	11¼	British	56–57	..	3 18 11
50,000	10	26 Feb.	11½	Bromley, Ordinary 10 p. c.	23–25	..	4 12 0
71,000	10	,,	8½	Do. 7 p. c.	18–20	..	4 5 0
500,000	10	28 Apl.	6	Buenos Ayres (New) Limited	10–10½	..	5 14 3
200,000	100	1 July	6	Do. 6 p. c. Deb.	100–102	..	5 17 8
150,000	20	26 Feb.	8½	Cagliari, Limited	30–32	..	5 3 1
100,000	10	11 June	8	Cape Town & District, Ltd	16½–17½	..	4 11 8
50,000	50	3 May	6	Do. 6 p. c. 1st Mort.	57–59	..	5 1 8
550,000	Stck.	9 Apl.	13½	Commercial Old Stock	342–347	..	3 17 9
165,000	,,	,,	10½	Do. New do.	257–262	..	4 0 1
165,000	,,	11 June	4½	Do. 4½ p. c. Deb. do.	152–156	+1½	2 17 8
800,000	Stck.	11 June	13	Continental Union, Limited.	250–255	..	5 1 11
200,000	,,	,,	10	Do. 7 p. c. Pref.	212–217	..	4 12 2
51,600	Stck.	26 Feb.	14	Croydon Com'cial A 10 p. c.	317–322	..	4 6 11
163,400	,,	,,	11	Do. B 7 p. c.	255–260	..	4 4 7
535,000	Stck.	26 Feb.	5½	Crystal Palace Ord. 5 p.c. Stk	139–142	..	3 13 11
60,000	,,	,,	5	Do. 5 p. c. Pref.	140–143	..	3 9 11
486,090	10	29 Jan.	11	European, Limited	24½–25½	..	4 6 3
354,060	10	,,	11	Do. £7 10s. paid	18–19	..	4 6 11
5,896,590	Stck.	12 Feb.	12¾	Gaslight & Coke, A, Ordinary	315–320	–2	3 19 9
100,000	,,	,,	4	Do. B, 4 p. c. max.	112–117	..	3 8 5
665,000	,,	,,	10	Do. C, D, & E, 10 p. c. Pf.	312–317	..	3 3 1
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	150–155	..	3 4 6
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	220–225	..	3 6 8
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	207–212	..	3 6 0
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	312–317	..	3 3 1
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	182–187	..	3 4 2
1,061,150	,,	11 June	4	Do. 4 p. c. Deb. Stk.	138–141	..	2 16 9
294,850	,,	,,	4½	Do. 4½ p. c. do.	150–155	..	2 18 0
908,000	,,	,,	6	Do. 6 p. c. do.	205–210	..	2 17 1
70,000	10	13 May	6	Hongkong & China, Limited	13½–14½	..	4 2 9
3,800,000	Stck.	13 May	10	Imperial Continental	217–222	..	4 10 1
376,400	100	1 Feb.	4	Do. 4 p. c. Debs. Red.	100–103	..	3 17 8
473,600	Stck.	12 Feb.	3½	Do. 3½ p. c. Deb. Stk ,,	104–107	..	3 5 5
75,000	5	29 June	6	Malta & Mediterranean, Ltd.	5½–6	..	5 0 0
560,000	100	1 Apl.	5	Met. of Melbourne, 5 p. c. Deb.	112–114	..	4 7 8
250,000	100	,,	4½	Do. 4½ p. c. Debs.	107–109	..	4 2 7
541,920	20	11 June	5	Monte Video, Limited	14½–15½	+½	6 9 0
150,000	5	27 May	8	Oriental, Limited	8⅛–8⅜	..	4 11 5
135,000	5	,,	8	Do. New, £4 10s. paid	7¼–7½	..	4 12 10
15,000	5	,,	8	Do. do. 1879, £1 paid	1½–2	..	4 0 0
60,000	5	26 Mar.	7	Ottoman, Limited	5–5½	..	6 7 3
420,000	100	3 May	6	People's Gas 1st Mtg. Bds.	104–109	..	5 10 1
500,000	100	1 June	6	of Chicago 2nd Do.	105–110	..	5 9 1
250,000	10	27 May	10	San Paulo, Limited	14½–15½	..	6 9 0
5,475,000	Stck.	26 Feb.	5½	South Metrop., 4 p.c. Ord.	143–146	+1	3 11 11
1,416,667	,,	—	3	Do. 3 p.c. Deb. Stk.	107–110	..	2 14 7
60,000	Stck.	12 Mar.	11½	Tottenham & Edmonton, A	275–285	..	4 0 10
60,300	,,	,,	8½	Do. B	190–200	..	4 5 0
182,380	10	27 May	10	Tuscan, Limited	13½–14½	..	6 18 0
149,900	10	1 July	5	Do. 5 p. c. Debs. Red.	100–103	..	4 17 1
				WATER COMPANIES.			
746,159	Stck.	29 June	10½	Chelsea, Ordinary	332–337*	+4	3 2 4
150,000	,,	,,	5	Do. 5 p. c. Pref.	177–180	..	2 15 6
160,000	,,	,,	4½	Do. 4½ p. c. Pref. Stk., 1875	157–160	..	2 16 3
175,785	,,	26 Mar.	4½	Do. 4½ p. c. Deb. Stock	160–165	..	2 14 6
1,720,563	Stck.	9 Apl.	7	East London, Ordinary	222–227	+1½	3 1 8
554,740	,,	29 June	4½	Do. 4½ p. c. Deb. Stk.	163–166	..	2 14 3
390,000	,,	,,	3	Do. 3 p. c. Deb. Stk.	106–108	..	2 15 7
700,000	50	11 June	7½	Grand Junction, 10 p.c. max.	119–124	+1	3 0 6
295,000	Stck.	26 Mar.	4	Do. 4 p. c. Deb. Stk.	148–153	..	2 12 4
708,000	Stck.	12 Feb.	12	Kent	347–351	..	3 8 3
160,000	,,	,,	7	Do. New, 7 p. c. max.	212–217	..	3 4 6
1,043,800	100	29 June	9½	Lambeth, 10 p. c. max.	280–285	..	3 8 5
406,200	100	,,	7½	Do. 7½ p. c. max.	217–222	..	3 7 7
350,000	Stck.	26 Mar.	4	Do. 4 p. c. Deb. Stk.	147–150	..	2 13 4
500,000	100	12 Feb.	13	New River, New Shares.	430–435	..	2 19 8
1,000,000	Stck.	29 Jan.	4	Do. 4 p. c. Deb. Stk.	152–155	..	2 11 7
902,300	Stck.	29 June	5	S'thwk & V'xhall, Ordinary	160–163	..	3 1 3
126,500	100	,,	5	Do. Do. 7½ p. c. Max.	150–153	..	3 5 4
489,200	Stck.	,,	5	Do. Do. 5 p. c. Pref.	173–178	..	2 16 2
1,019,585	,,	9 Apl.	4	Do. 4 p. c. A Deb. Stk.	145–148	..	2 14 2
1,155,066	Stck.	11 June	10	West Middlesex	312–317	+2	3 3 1
200,000	,,	,,	4½	Do. 4½ p. c. Deb. Stk.	162–167	..	2 13 11

*Ex div.

Coupar Angus Gas Company have declared a dividend at the rate of 6 per cent., and reduced the price of gas by 2½d. per 1000 cubic feet—making it now 5s. 10d. The Crieff Gaslight Company have paid a dividend at the rate of 5 per cent., and a bonus of 1s. per share (equal to 10 per cent). They have reduced the price of gas from 4s. 2d. to 3s. 9d. per 1000 cubic feet; and have further reduced the charges for the hire of gas cooking-stoves from 10 to 5 per cent. on the cost price. The Auchterarder Gaslight Company have declared a dividend at the rate of 8 per cent.; the Kirriemuir Company, at the rate of 5½ per cent; and the Blairgowrie Company, at the rate of 4 per cent.

Bailie Hamilton, the Convener of the Works Committee of the Falkirk Gas Commission, reported to the Commissioners this week that the Contractors for the erection of the wire-rope guided gasholder (Messrs. Ashmore, Benson, Pease, and Co., Limited), had now got the holder upright and in position. There had been, he said, a story going round that the foundations of the tank were not sound; but this had been falsified. He was also glad to be able to say they were going to have a good surplus in their gas accounts; he believed it would amount to four figures. He thought it was satisfactory that they had not only been able to reduce the price of gas, but had made such a large profit.

In the Edinburgh Bankruptcy Court this week, Paul Stork, of Portobello, was examined in a petition for *cessio bonorum*. Stork said he was a medical student, but that since January, 1896, he had carried on business as the Excelsior Light Company in Hanover Street, Edinburgh. He had no capital when he started; but a banker in Portobello contributed £115 to the business. He borrowed money from his wife to carry on the concern. The banker got frightened because of an action by the Incandescent Gas Company, Limited, against the Excelsior Company; and he had nothing more to do with the business. He accounted for the deficiency on his estate, by the fact of the low prices which were obtained when the stock was sold off. Lamps which had cost 50s. were sold for 2s. 6d. Had the stock fetched cost price, all the creditors would have been paid. His assets amounted to £11 10s. 7d.; and his liabilities, to £323 10s. 6d.—leaving a deficiency of £311 19s. 11d. A trustee was appointed on the estate.

During the past year, the daily consumption of water in Dundee and the district served by the Dundee Corporation Water Department amounted to 8,805,429 gallons, as compared with 9,498,940 gallons in the year preceding. The revenue was estimated at £50,534; and it turned out at £51,553—or more than £1018 above the estimate. The domestic rate yielded more than was expected by £250; and the remaining increase was mainly derived from meter-rents. The estimated expenditure was £50,415, and the actual expenditure was £169 less. Of this, annuities amounted to £14,315; interest on borrowed money to £17,827; contribution to sinking fund, to £6024; and maintenance and management to £7938. The expenditure on capital account amounted to £2479. There has always been complaint at the high charges for water for trade purposes in Dundee. This year the aggrieved parties went a step further than usual, by sending a deputation to the Town Council on the subject. They were received last Thursday week. The deputation had been appointed by the Chamber of Commerce. Their spokesman pointed out that, while the domestic rate had been reduced since 1890 from 1s. 2d. to 1s. per pound, the charges for trade purposes had remained at 7d. per 1000 gallons, which was the maximum. He believed that the water was brought into the city at a total cost of 3¾d. per 1000 gallons; and he did not see why it could not be sold at this figure, *plus* a reasonable charge for the debt on the undertaking. His firm were not interested in the matter, as they had sunk a deep well for themselves, and now scarcely required any of the city water. Treasurer Ritchie followed the speaker. He submitted the estimates which had been framed for the current year, and which showed an expenditure of £49,135, or £1110 less than last year's estimate. Adding this sum to the surplus of £1307 brought forward, they had £2400 at their disposal. But this was not all. The assessable rental of the city continued to grow, the addition last year having been £10,000; and having regard to this fact, they calculated that they would have at least £3000 with which to effect a reduction upon some class or other of the rates. He had carefully considered which class they were to confer the benefit of a reduction upon; and while he had sympathy with the views which had been laid before them, he had come to the conclusion that there was no city in Scotland where special consumers, as contrasted with domestic ones, received such favourable treatment as in Dundee. Even with a domestic rate at 10d. per pound, traders would be more favourably placed in Dundee than in Edinburgh or Aberdeen, and would be almost in the same position as in Glasgow. The relative prices in these towns were: Edinburgh, domestic, 5d. per pound, and trade, 6d. per 1000 gallons; Glasgow, 6d. and 4d. respectively; and Aberdeen, 7d. and 7d. respectively. He therefore thought it would be unjust to lower the existing trade prices while the domestic rate was so high; and he moved that the special rate remain at 7d. per 1000 gallons; that the domestic rate be reduced to 10d. per pound; and that the public rate be retained at 1d. per pound. This, after a long discussion, was agreed to by 21 votes to 2. All that I have to say is that the Treasurer would have followed a more enlightened policy if, instead of trying to justify a high charge by comparison with the domestic rates in other cities, he had compared the trade rates, and pointed out that, with a rate of 4d. in Glasgow and 6d. in Leith (which is supplied by the Edinburgh Water Trust), it was not likely that traders would be attracted to Dundee; and that an increase in the number of manufacturers was the best means for leading to an augmentation of the total amount derived from the domestic rate, which could then be reduced.

The Police Commissioners of Arbroath are still continuing their policy of seeking for a water supply underground. They have sunk a well, with very great difficulty, and are now endeavouring to drive adits to east and west of it, but with very small success. The adits are in gravel, surmounted by boulder clay; and it is found that the clay is giving great trouble by falling in. The difficulties seem to have been too much for the Convener of the Water Committee, as he resigned a week ago. Perhaps he is beginning to see that this source of water supply is likely to be as costly as the gravitation scheme they rejected two years ago, and is not likely to be nearly so effective. Meantime, the work is absolutely at a standstill.

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CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 10.

Sulphate of Ammonia.—Throughout the week, the market has been quiet, but steady; and quotations remain at £7 10s. per ton f.o.b. Leith and Hull, and £7 12s. 6d. per ton f.o.b. Liverpool. On the one hand, buyers will not advance on the above prices, having no urgent requirements to fill; while, on the other hand, makers being comfortable as regards stocks, are equally firm in resisting any decline. Interest still centres mainly in the forward position; but divergent views as to values hinder extensive business. There would be buyers up to the end of the year at the equivalent of £7 12s. 6d. per ton f.o.b. east-coast ports; but this is much below makers' idea of value. London quotations are about £7 15s. to £7 17s. 6d. per ton, July-December delivery; but some forward business is being taken by speculators at less money.

Nitrate of Soda is rather firmer, especially in the forward position, in anticipation of further restrictive action on the part of producers. On spot, the quotations are 7s. 6d. per cwt. for ordinary, and 7s. 7½d. for fine, quality.

LONDON, *July* 10.

Tar Products.—A sudden change in the policy of buyers, doubtless due to a better outlook in the aniline market, is the explanation of benzols so suddenly assuming a better value. The enormous production of benzols from coke-ovens makes it difficult to manipulate the benzol market as compared with former years. The enlarging use of aniline, however, has taken up the increased production; and at present it cannot be said that the surplus is being employed for fortifying gas. After realizing 2s. 3d., 90's benzol is to-day quoted lower. Nevertheless there are buyers for quantities at the prices quoted below. There is a little more inquiry for pitch; but the future of this article cannot well be forecast. It is, however, unlikely that there will be any important improvement at present. Creosote and tar oils are very marketable, and are said to be scarce. Anthracene is dull; but a little more hopeful, as the demand for alizarine is improving.

Average values are as follows: Tar, 15s. to 19s. Pitch, 18s. to 21s. Benzols, 90's, 2s. 1d.; 50's, 2s. [The price was wrongly quoted—a printer's error—last week as 1s. 2d., instead of 2s. 2d.] Toluol, 2s. 2d. Solvent naphtha, 1s. 7d. Crude, 30 per cent., naphtha, 1s. Creosote, 2½d.; liquid, 2¼d. Heavy oils, 37s. 6d. Carbolic acid, 60's, 1s. 10d. Pressed naphthalene, 62s. 6d. Creosote salts, 27s. 6d. Anthracene, nominal, "A," 6d.; "B," 5d.

Sulphate of Ammonia is enjoying a steady and moderately active market. Important shipments are being made; and the home consumption has been pretty good. Business has been done at prices ranging from £7 8s. 9d. to £7 11s. 3d. at all ports, less 3½ per cent.

Wellow Water Supply.—Col. J. O. Osted held an inquiry last Friday in respect of the application of the Bath Rural District Council to borrow £1080 for water-works at Wellow. The scheme was strongly opposed.

COAL TRADE REPORTS.

From Our Own Correspondent.

Lancashire Coal Trade.—The only special feature to notice in the coal trade is the improved position as regards the lower qualities, suitable for steam and forge purposes, brought about by the activity in the demand for shipment. On shipping orders, colliery proprietors are now getting quite 6d. per ton above the prices which were taken last year. Ordinary descriptions of steam coal are fetching from 7s. 6d. to 7s. 9d. per ton delivered at the ports on the Mersey; similar qualities having been sold last year at as low as 7s. Prices now being obtained leave about 5s. 9d. per ton as an average figure at the pit. This is helping to steady inland rates for steam and forge coals; and they remain at about 6s. to 6s. 3d. per ton at the pit. But the general strike and lockout in the engineering industries cannot fail to have a depressing effect upon this branch of the coal trade. It is generally expected that the dispute in any case will extend over two or three months, as both sides are determined to fight the matter out to the last, and the masters were never in a stronger position for carrying on a protracted conflict with the Trades Union organization. The better qualities of round coal are necessarily now hanging upon the market, and accumulating in stock, with pits working on an average scarcely four days per week. Prices are without quotable change, but easier, if anything. Engine fuel moves off fairly well; and with a lessened supply of the better sorts, prices are steady. Common descriptions, however, are generally plentiful and low in price. At the pit mouth, best sorts are fetching 4s. 3d. to 4s. 9d. per ton, with 5s. quoted for some special sorts; medium qualities, 3s. 9d. to 4s. 3d.; and common slack, 3s. to 3s. 6d. The engineering strike is, however, also likely for the time being to very considerably lessen the requirements for coke; and this will materially affect prices for slack, especially the lower qualities. One result during the last few days has been considerable pressure to close contracts; and colliery proprietors are rather disposed to take less prices than they recently held out for.

Northern Coal Trade.—There has been an increased demand for coal the last few days; and as some local strikes have taken place at both steam and gas coal collieries, fuel is scarcer, and prices are firmer. Best Northumbrian steam coals are steady at 8s. 7½d. to 8s. 9d. per ton f.o.b.; second-class steam being quoted at 8s. 3d.; and steam smalls at 3s. 9d. In gas coals there is a tendency towards higher prices; and the production, though large for this season of the year, is still well taken up. The announcement is locally made to-day that the collieries of Lord Londonderry, who is among the largest of the gas coal producers, are to be converted into a limited liability company, with the view of a fuller development of the pits. Prices of gas coal may be put as from 7s. to 7s. 3d. per ton f.o.b., though there are some coalowners who ask higher rates for single cargoes. There is no alteration in the price of gas coke recorded this week; but the production is now again beginning to increase. The strike of the engineers would seriously interfere with the coal industry, and in time would throw a considerable quantity of fuel on the market.

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"*Secretary and Manager.*

28/6/1897.

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"I am, yours faithfully,
"(Signed) JOHN J. JERVIS,
"*Secretary and Manager.*"

"J. T. WESTCOTT, Esq.

N.B.—The M.-W.-P. Plant is built under penalty to Manufacture Gas on less Raw Material than any other Plant on the Market.

All Enquiries to be Addressed to the Company's Offices.

Scotch Coal Trade.—The shadow of the holidays, which begin on the 16th inst., and last during nearly the whole of the following week, is on the coal trade. Orders are booked to keep going till then; and after that the work of supplying contracts newly entered into will be taken up in earnest. Most of the large contracts for the year have been disposed of; so that, unless for shipping, there will not be so much on the market as there has been. Taken all over, the rates which have been obtained this year are from 3d. to 6d. per ton higher than those of last year. The prices quoted this week are: Main, 6s. 3d. per ton f.o.b., Glasgow; ell, 7s. to 7s. 6d.; and splint, 6s. 6d. to 6s. 9d. The shipments for the week amounted to 192,714 tons—an increase of 30,773 tons upon the previous week, and of 26,499 tons upon the corresponding week of last year. For the year to date, the total shipments have been 3,781,825 tons—an increase over this period last year of 119,283 tons.

Southport Corporation Gas Undertaking.—The Manager of the Southport Corporation Gas-Works (Mr. J. Booth) has issued his annual report. He states that the total quantity of gas made during the past financial year was 374,223,000 cubic feet—an increase over the previous year of 16,738,000 cubic feet, or 4·68 per cent. The total quantity of gas sold was 356,640,800 cubic feet—an increase of 23,205,900 cubic feet, or 6·95 per cent., on the previous year. The unaccounted-for gas—14,836,200 cubic feet—showed a decrease of 6,710,900 cubic feet, being equal to 2·06 per cent. The gross profit for the year was £16,389; and the net profit, after making the capital charges, was £9039. The abolition of meter-rents and other less important matters had affected the net profit by about £2000.

The Accident Fund of the South Metropolitan Gas Company.—The Profit-Sharing Committee of the South Metropolitan Gas Company have adopted a set of rules which have been drawn up in connection with the Company's accident fund, which starts this month; and a copy was given to every man in the service, with an invitation to join the fund. The Company subscribe 1s. a quarter per man, on the greatest number of men, regular and casual, employed in any week in the quarter; the member's subscription being ½d. per week or 6d. a quarter. It is gratifying to find that, in response to the invitation, out of about 3000 men of all grades, the whole of them, with one exception, voluntarily joined the fund. They were free to choose for themselves whether they would do so; and the result shows their appreciation of this effort to compensate them for loss arising through accident.

Messrs. W. Parkinson and Co. held a very successful gas exhibition from Tuesday to Friday last week in the Town Hall, Luton; Miss Edith Sanderson giving practical demonstrations on cookery twice daily during the exhibition.

Messrs. Fletcher, Russell, and Co, Limited, have recently been exhibiting their gas cooking ovens and ranges, gas-fires, and other appliances, in the Co-operative Hall, Oldham. Practical cookery demonstrations were given by Mrs. H. M. Young.

An exhibition of the domestic gas appliances manufactured by Messrs. C. Wilson and Sons is being held in the crypt of the New Town Hall at Middlesbrough. It was opened yesterday week, and will continue to the 16th inst. The cookery lectures are being delivered by Miss. Holroyd.

Messrs. J. & H. Robus are at present engaged upon the re-arrangement of the Totnes Gas-Works. The contract includes the excavation for, and construction of, a 60 ft. by 18 ft. gasholder and tank complete, the enlargement of the mains in the principal streets, retort work, and a new governor. At the Bodmin Gas-Works, the firm's shallow regenerator settings are being put in. These contracts, together with renewals at other works in the south-west of England, are being carried out under the immediate supervision of Mr. Sidney Francis.

In view of the action of the Home Office in bringing carbide of calcium under the Petroleum Acts, the Acetylene Illuminating Company, Limited, have issued a pamphlet on the subject which will be found useful to local authorities and others. It contains general particulars as to the nature of carbide of calcium and acetylene gas, together with the fire-office regulations, and abstracts of the Petroleum Acts, 1871 to 1881, and the regulations issued by the Public Control Department of the London County Council in regard to carbide, and a copy of the licence for keeping it. It is pointed out in the preliminary observations that it is optional for local authorities to modify the suggestions made by the Council in any manner they may think desirable.

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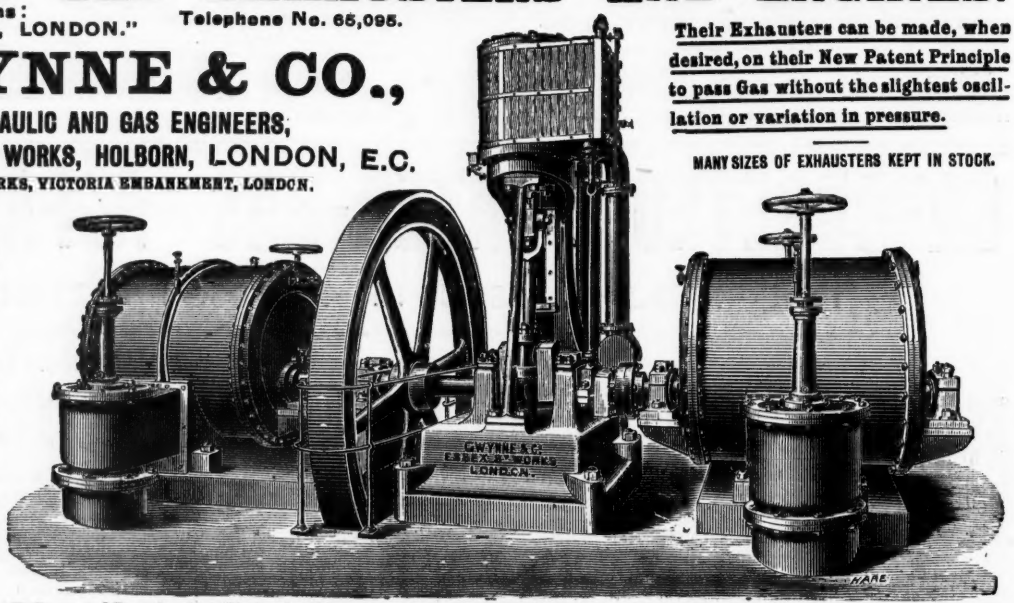

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Telegraphic Address: "Braddock Oldham."

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JOHN NICHOLSON & SONS, Limited, Chemical Works, Leeds, specially produce this ACID from SULPHUR, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings at home and abroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.

Telegraphic Address: "PORTER LINCOLN."

[For Illustrated Advertisement, see July 6, p. 68.]

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality. SPECIAL FIRE CEMENT, OXIDE PAINTS, OILS, SULPHURIC ACID, &c.

190 and 191, NEWGATE STREET, LONDON, E.C.

Telegrams: "BOGORE, LONDON."

SULPHATE OF AMMONIA SATURATORS.

JOSEPH TAYLOR & CO., Chemical Plumbers, &c., and Makers of every description of Solid Plate Lead and Timber Cased Saturators, &c., CENTRAL PLUMBING WORKS, TOWN HALL SQUARE, BOLTON. Special Attention to Repairs.

Before placing Orders, please write for Estimate.

PATENTS FOR INVENTIONS.

J. C. CHAPMAN, M.I.M.E. and Fel. Chartered Inst. Patent Agents. ADVICE ON ALL MATTERS CONNECTED WITH ABOVE. Information and Handbook on application.

70, CHANCERY LANE, LONDON, W.C.

NOTICE TO ADVERTISERS.—COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office *not later* than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS, should be received not later than the FIRST POST on SATURDAY.

AMMONIACAL LIQUOR wanted.
BROTHERTON AND Co., Ammonia Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

GAS TAR wanted.
BROTHERTON AND Co., Tar Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SPENT OXIDE wanted.
BROTHERTON AND Co., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

SULPHURIC ACID for Sale.
BROTHERTON AND Co., Chemical Manufacturers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

TUBES for Gas, Steam, and Water (all Sizes), Welded or Riveted. TANKS, HYDRAULIC MAINS, RETORT-LIDS, &c.
JOHN SPENCER, Globe Tube Works, WEDNESBURY; and 14, Great St. Thomas Apostle, LONDON.

HUTCHINSON BROTHERS, Gas Engineers, &c., Falcon Works, Barnsley, Makers of Wet and Dry Gas-Meters, Brass-Work, and general Gas Apparatus, Lead Saturators, Tanks, &c., Tools, and Gas-Works Sundries. (See p. 69, last week's issue.)
Telegrams: "HUTCHINSON BROS., BARNSLEY."

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron.
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

APPOINTMENT wanted by an experienced Gas Engineer, as CHIEF or ASSISTANT, or any position of trust therewith. Well up in all details of Gas Management, including Carburetted Water Gas. Good Credentials. No objection to going abroad.
Address No. 2874, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

A GENTLEMAN and Engineer, with extensive connection and knowledge of most Gas-Works in the Kingdom, is now at liberty to act as AGENT or REPRESENTATIVE to good Contracting Engineers, to advise as to Extensions, prepare preliminary Plans, &c.
Address No. 2882, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

CARBURETTED WATER GAS.

MR. ARTHUR MEAD begs to intimate that he is now in a position to independently advise Gas Companies and Corporations as to the adoption of Carburetted Water Gas, the Comparative Cost of Manufacture, Selection and Cost of Plant, Site, and, where necessary, prepare Sketch Plan and Specification for Tender.
Temporary Address: 2, Dorset Buildings, Salisbury Square, LONDON, E.C.

WANTED, at once, a good Stoker used to Shovel Charging, Engine and Exhauster, and willing to make himself generally useful. To a steady and industrious Man, a permanency. Wages 24s. 6d. in Summer, and 26s. 3d. in Winter. Married Man preferred.
Apply, with References, to MANAGER, Gas-Works, Chepstow, MON.

WANTED, a Practical Working MANAGER for a Provincial Gas-Works making 20 Millions. Good Carbonizer, must understand Engine, Exhauster, Photometer, and be able to set Retorts. Wages 35s. per week, with House, Coal, and Gas. State Age, present Engagement, with *copies* of three recent Testimonials.
Address No. 2879, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, at a Country Mansion, a Person to take charge of, and work, a small Gas House, also an Installation of Electricity (produced by an Oil-Engine), and a small Gas-Engine for pumping Water. No one need apply who cannot produce the highest Testimonials as to ability and personal Character.
Apply, by letter only, to Mr. LEWIN WHITE, Shipbourne, Tonbridge, KENT.

WANTED, a good Draughtsman in a Gas Engineer's Office. Capable of getting out Working Drawings for all kinds of Gas-Works Buildings and Plant. Must have had Six or Seven Years' good Experience as a Draughtsman. First-Class recent Testimonials absolutely necessary. Wages 35s. a week.
Apply, by letter, to No. 2873, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

SADLER & Co., Ld., Middlesbrough; ULVERSTON (BARROW); PORTSMOUTH; CARLTON (N.E.R.); and STOCKTON. Tar and Petroleum Distillers. Benzol and Petroleum Spirit, 700 and other Gravities specially prepared for Carburetting. SOLAR OIL for Gas Making, Kerosene, &c.
Correspondence invited.
Telegraphic Address: "Sadler, Middlesbrough."

NEW GAS PLANT CEMENT.

JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
For all Joints in connection with Oil-Gas Plant and Sulphate Plant.
For all Gas Joints.
For all Tar Joints.
For all Ammonia Joints.

SULPHATE OF AMMONIA SATURATORS.

WALTER THOMASON and SONS, Chemical Plumbers, &c., and Makers of Lead Saturators, &c., 21, WESTON STREET, BOLTON. Repairs of every description.
Please write for Estimate before ordering elsewhere.

ALEX. P. KER, C.E., Consulting Gas Engineer, Hunton Road, Gravelly Hill, Birmingham, 25 Years Assistant Engineer and Manager of Works to the Corporation of Birmingham and their predecessors, MAY BE CONSULTED on all matters connected with GAS ENGINEERING, including Valuations, Alterations, Additions and Extensions, &c. REPORTS upon EXISTING WORKS and IN PROGRESS. EXAMINATIONS OF GAS for ILLUMINATING POWER and IMPURITIES conducted. Plans, Specifications, and Estimates prepared.

CLERK of Works Wanted, in the Midlands. Experienced Hand.
State Terms and References to No. 2881, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

STOKERS Wanted, used to Shovel Charging, and Engine and Exhauster. Wages, 31s. to 35s. per week.
Apply to S. BARK, Gas-Works, GODALMING.

WANTED, a competent Young Man for Ironwork, Brickwork, &c. (Gas-Works Extension); the work to last for about 18 Months.
Apply, before the 15th inst., with References, and stating Salary required, to No. 2876, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a steady and trustworthy GAS STOKER, used to Shovel Charging. Permanent employment to a strictly sober and reliable man.
Apply, stating Age, Wages, &c., required, to Mr. G. MOAT, Manager, Gas-Works, Purston, PONTEFRACT.

RETORT-HOUSE Foreman wanted for a Gas-Works where about 25,000 Tons of Coal are used. Age not over 40. Wages £2 2s. per week. Preference will be given to one having experience in Inclined Retorts and Regenerative Furnaces.
Apply, by letter, to No. 2880, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS Stokers (Two) wanted, used to Shovel Charging, and Engine and Boiler. Permanent job to steady Men. Wages 4s. 6d. per twelve-hour Shift.
Apply, by letter only, to T. LAYTON, Manager and Secretary, Gas-Works, REDDITCH.

WANTED, at a Provincial Gas-Works, a RETORT-HOUSE FOREMAN. Must be under 40. One having knowledge of Carburetted Water-Gas Manufacture preferred. *Copies* of Characters only to be forwarded. Wages £2 per week.
Apply, by letter, to No. 2866, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

METER INSPECTOR AND FITTER.

WANTED, in a small Town of about 6000 Inhabitants, an energetic reliable person as METER INSPECTOR and FITTER. He must be a careful Meter Reader and a practical Gas-Fitter, thoroughly acquainted with Gas Cooking-Stoves, Fires, Burners, laying Mains, and able to do general Repairs and also to advise Consumers as to their Gas Supply.
Apply, in own handwriting, stating Experience, Age, present Occupation, and Wages required, to No. 2877, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

RUSHDEN AND HIGHAM FERRERS DISTRICT GAS COMPANY, LIMITED.

WANTED, a Manager. Salary £200 per annum, with House. Large Modern Works. Make 37,463,000 cubic feet (rapidly increasing). Will be required at end of September.
Further Particulars may be obtained from the Secretary, to whom Applications, accompanied by not more than three recent Testimonials, must be addressed on or before the 28th of July, 1897.

GEO. S. MASON,
Secretary.

Rushden, R.S.O., Northants,
July 10, 1897.

CANNEL, COAL, ETC.

JOHN ROMANS & SON, EDINBURGH, Gas Engineers, supply all the most approved SCOTTISH CANNELS; also FIRE-CLAY GOODS, CAST-IRON PIPES, and other APPARATUS for GAS and WATER WORKS.
Prices, &c., will be forwarded on application to No. 80, ST. ANDREW SQUARE, EDINBURGH, NEWTON GRANGE, NEWBATTLE, DALKEITH, } SCOTLAND.

TO GAS AND WATER OFFICIALS.

SPECIAL and Favourable Terms for CYCLES are offered. The very best "up-to-date" Cycle at a reasonable Cost. "Dunlop" Tyres, Weldless Tube throughout, "Westwood" Rims, "Brook's" Saddle, "Perry's" or "Renold's" Chain, &c. The whole combining to make as fine a Machine as is possible to be made. Satisfaction guaranteed. Send at once for Catalogue post free.
MELROSE CYCLE COMPANY, COVENTRY.

ECONOMY IN PURIFICATION.

INCREASE the Efficiency of your PURIFIERS by adopting CRIPPS'S PATENT BYE-PASS VALVE in the lower Tiers of Sieves. Practical Experience proves their Economy. Engineers are repeating orders after thorough trial.
References and Particulars can be obtained from the Makers—
C. & W. WALKER, Midland Iron-Works, Donnington, near Newport, SALOP.
And J. EVERY & SON, Phœnix Iron-Works, LEWES.

WANTED, Retort Setters and Bricklayers.
Apply to R. DEMPSTER AND SONS, LIMITED, Elland, YORKS.

GAS CARBON Wanted, not less than 4-Ton Loads.
Apply to the BRIMINGTON CARBON COMPANY, Sowerby Bridge, YORKS.

PUREST, Faultless Thorium (High Lighting Power guaranteed) is supplied regularly on very Low Terms.
Address J.Y. 6965, care of Rudolf Mosse, BERLIN, S.W.

FOR SALE—A Station Meter complete, in thorough working order. Recently overhauled and certified correct by Messrs. Braddock. Capacity, 50,000 feet per hour.
Apply to JOHN H. DARBY, Brymbo, near WREXHAM.

FOR SALE—A Station Meter, 5-inch Connections (Milne's make).
For further Particulars and Price, apply to
A. FORRETT,
Manager.
Gas-Works, Blackwell, near Alfreton.

GAS-PUMP for Sale, horizontal, one Steam Cylinder, 18-inch bore, and two Gas Cylinders, 17½-inch bore, all 24-inch Stroke, on massive Bed-Plate, with heavy Fly-Wheels. Very strong. First-Class Make. Not much used.
Apply, by letter, to No. 2878, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also COMPLETE WORKS equal to 7000, 20,000, 60,000 cubic feet per diem. **Inquire and compare Prices and Particulars before ordering elsewhere.**
J. F. BLAKELEY, Gas Engineer, Ravensthorpe, YORKS.

FOR IMMEDIATE SALE—Oil Plant, consisting of Three Stills, about 6 ft. 6 in. diameter by 14 ft. deep, with Pipes and Tanks, Fire-Doors, Frames, and Bars. Two TANKS, about 12 ft., 4 ft. wide, 9 ft. deep, fitted with Agitators and Shafting to work same. One HYDRAULIC PRESS and PUMP. TANKS of all sizes, Circular and Horizontal.
Apply, for full Particulars and Prices, to H. I. WILLIAMS AND Co., Kidsgrove, STAFFORDSHIRE.

BOROUGH OF DEWSBURY.

THE Lighting Committee of the above Corporation invite TENDERS for the supply and delivery during the Twelve Months ending the 31st day of August, 1898, of—
(1) SULPHURIC ACID.
(2) WET and DRY GAS-METERS.
(3) PREPAYMENT DRY GAS-METERS.
(4) CAST-IRON GAS and WATER PIPES.
Specification and Forms of Tender may be obtained on application to the Gas Engineer, Mr. Chas. A. Craven, Gas-Works, Savile Town, Dewsbury.
Tenders, under sealed covers, endorsed "Sulphuric Acid," "Meters," "Cast-Iron Pipes," &c., as the case may be, to be sent to me not later than Saturday, the 17th inst.
The Corporation do not bind themselves to accept the lowest or any tender.

By order,
G. TREVELYAN LEE,
Town Clerk.

Town Hall, Dewsbury,
July 8, 1897.

THE KNUTSFORD LIGHT AND WATER COMPANY

INVITE Tenders for 2650 Tons of Gas COAL and 600 Tons of CANNEL, to be delivered at Knutsford Station during the Two Years commencing July 31, 1897.

The Company do not bind themselves to accept the lowest or any tender.

Tenders to be sent in on or before the 19th inst., addressed to the Chairman.

THE KNUTSFORD LIGHT AND WATER COMPANY

INVITE Tenders for their production of GAS TAR and AMMONIACAL LIQUOR for the Twelve Months ending July 1, 1898.

State Prices for Liquor of 5°, 5½°, 6°, 6½°, and 7° Twaddel.

The Company do not bind themselves to accept the lowest or any tender.

Tenders to be sent in on or before the 19th inst., addressed to the Chairman.

ISLE OF THANET GASLIGHT AND COKE COMPANY, MARGATE.

TO SULPHURIC ACID MAKERS.

THE Directors of the above Company are prepared to receive TENDERS for the supply of 80 per cent. PYRITES ACID (B.O.V.) of specific gravity 1710/20, for the Twelve Months commencing the 1st of August next, to be delivered in Carboys at Margate Station, L.C. & D. Railway, or S.E. Railway. The Price quoted also to include the return of the empty Carboys.

Delivery will be taken at the rate of Two Trucks per day—i.e., about 64 Carboys; and from 50-75 tons is the average amount of each Order—the estimated total requirements for the Year being about 150 Tons; but the quantity required may be more or less.

Terms: Net Cash monthly.

For any further Particulars, apply to the Engineer and Manager, Mr. H. H. Jones.

Sealed tenders, addressed to the Chairman of the Company, endorsed "Tender for Acid," and accompanied by a sealed sample of the Acid quoted for, to be delivered at these Offices on or before Thursday, the 22nd inst.

The Directors do not bind themselves to accept either the lowest or any tender.

By order,
THOS. C. FULLER,
Secretary.

Gas Offices, Margate,
July 10, 1897.

ISLE OF THANET GASLIGHT AND COKE COMPANY, MARGATE.

TENDERS FOR PETROLEUM SPIRIT.

THE Directors of the above Company are prepared to receive TENDERS for the supply of PETROLEUM SPIRIT of ·700 specific gravity for Six or Twelve Months from the 1st of August, 1897.

For Particulars as to Quantity and mode of Delivery, apply to the Engineer and Manager, Mr. H. H. Jones.

Sealed tenders, addressed to the Chairman of the Company, endorsed "Tender for Petroleum Spirit," to be delivered at these Offices on or before Thursday, the 22nd inst.

The Directors do not bind themselves to accept either the lowest or any tender.

By order,
THOS. C. FULLER,
Secretary.

Gas Offices, Margate,
July 10, 1897.

BOROUGH OF ROCHDALE.

TO CHEMICAL MANUFACTURERS.

THE Gas Committee of the Corporation invite TENDERS for the supply of such quantities of BROWN OIL OF VITRIOL as they may require during the ensuing Twelve Months; the Acid to be made from Pyrites or recovered Sulphur, and to be delivered at the Rochdale Railway Station.

Further Information can be obtained from Mr. T. Banbury Ball, the Manager at the Gas-Works.

Tenders, endorsed "Vitriol," must be sent to me not later than noon of Wednesday, the 21st inst.

By order,
JAMES LEACH,
Deputy Town Clerk.

Town Hall, Rochdale,
July 10, 1897.

TO GASHOLDER AND PURIFIER MAKERS.

THE Town Commissioners of Cashel, County Tipperary, Ireland, invite TENDERS for the erection of a new TWO-LIFT TELESCOPE GASHOLDER (counter-balance), to be placed in a Stone Tank already erected.

Also two new PURIFIERS, 5 ft. by 4 ft., with the necessary Connections, Valves, and Lifting Gear.

Also the RE-LAYING of MAINS on Works.

Plans and Specifications to be seen at the Town Hall, Cashel.

Sealed tenders, to be addressed to the Town Clerk, Cashel, County Tipperary, Ireland, and endorsed "Tender for Gasholder, &c.," will be received by the undersigned not later than Twelve o'clock noon, on the 2nd of August next.

The Contractor will be obliged to enter into a Bond with two solvent sureties for the due completion of Contract, to the satisfaction of the Engineer appointed by the Board.

Anyone requiring Plan and Specification must apply personally, and check all Measurements in the Specification.

The Commissioners do not bind themselves to accept the lowest or any tender.

By order,
JOHN O'LEARY,
Town Clerk, &c.

Town Hall, Cashel,
July 7, 1897.

TO OXIDE OF IRON MERCHANTS.

THE Corporation of Birkenhead are prepared to receive TENDERS for the supply of 350 Tons of OXIDE OF IRON.

Forms of Tender and other Information may be obtained from Mr. T. O. Paterson, Gas Engineer, Gas-Works, Thomas Street.

Tenders, sealed and endorsed "Tender for Oxide of Iron," to be sent to me not later than Five p.m. on Friday, the 23rd of July, 1897.

Deliveries to be made within one month of written Instructions from the Gas Engineer.

The Corporation do not bind themselves to accept the lowest or any tender.

By order,
ALFRED GILL,
Town Clerk.

Town Hall, Birkenhead,
July 10, 1897.

SHEFFIELD UNITED GASLIGHT COMPANY.

TO IRONFOUNDERS, &c.

THE Directors of this Company invite TENDERS for the supply and delivery of CAST-IRON COLUMNS and GIRDERS, WROUGHT-IRON TIE-RODS, &c. (weighing about 175 tons), required in the construction of underground Tar and Liquor Tanks at their Grimesthorpe Station.

Drawings may be seen, and Specification with Bill of Quantities obtained, on application to the Engineer, Mr. Fletcher W. Stevenson, on payment of 10s. 6d., which will be returned on receipt of a *bond-fide* tender.

Sealed tenders, endorsed "Tender for Ironwork for Liquor Tanks," must be delivered by post to the undersigned at the Company's Offices not later than the first post on Saturday, the 31st day of July.

The Directors do not bind themselves to accept the lowest or any tender.

HANBURY THOMAS,
General Manager and Secretary.

Commercial Street, Sheffield,
July 6, 1897.

SHEFFIELD UNITED GASLIGHT COMPANY.

FIRE-CLAY GOODS.

THE Directors of this Company invite TENDERS for the supply of FIRE-CLAY GOODS required in the construction of Thirty Vaults for Retort-Benches at their Grimesthorpe Station.

Specification and Form of Tender may be obtained on application to the Company's Engineer, Mr. Fletcher W. Stevenson.

Sealed tenders, endorsed "Tender for Fire-Clay Goods," must be delivered to the undersigned (by post) at the Company's Offices not later than the first post on Saturday, the 31st day of July.

The Directors do not bind themselves to accept the lowest or any tender.

HANBURY THOMAS,
General Manager and Secretary.

Commercial Street, Sheffield,
July 6, 1897.

BRIERLEY HILL DISTRICT GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors are prepared to receive TENDERS for the supply of 6000 Tons of GAS COAL, delivered to Brettell Lane or Round Oak Siding (G.W.R.), in such quantities as may be required from the 1st of July to the 30th of June, 1898.

Tenders, stating price per ton (20 cwt.), delivered to the above-mentioned Stations, with latest Analytical Test, to be sent, addressed to the Chairman of the Company, and marked "Tender for Coal," not later than the 17th inst.

The Directors reserve the right to accept tenders for the whole or any portion of any quantity offered, and do not bind themselves to accept the lowest or any tender.

No Tender Forms issued

By order,
HENRY M. JACKSON,
Secretary.

Board-Room, Gas-Works,
Brierley Hill, July 5, 1897.

COUNTY BOROUGH OF SALFORD.

(GAS DEPARTMENT.)

GENERAL STORES.

THE Gas Committee invite Tenders for the supply of the following MATERIALS, in such quantities as may be required, during the Twelve Months from date of acceptance of tender, viz.:—

1. Wrought Iron and Steel.
2. Lead Pipe, Block Tin, Tubing, &c.
3. Bolts, Nuts, Rivets, and Meter Screws, &c.
4. Iron Castings, Cast-Iron Pipes, &c.
5. Gun Metal Meter Taps and Keys and Brass Lamp Taps.
6. Wrought-Iron Steam and Gas Tubing and Sundry Fittings.
7. Gas-Meters.
8. Paints, White and Red Lead, &c.
9. Chandlery.
10. Oils and Tallow.
11. Cotton Waste.
12. Cement and Lias Lime
13. Timber.
14. Ropes, Yarn, and Twine.
15. Steel Shovels, Galvanized Iron Scoops and Buckets.
16. Brushes.
17. Testing and Repairing of Weighing-Machines.
18. Phosphor Bronze and Gun Metal Fittings for Meters.

Forms of Tender and all Information may be obtained, and Samples seen, on application to the Gas Engineer, Gas Offices, Bloom Street, Salford.

Sealed tenders, endorsed "Tender for Stores," addressed to the Chairman of the Gas Committee, Town Hall, Salford, to be delivered to me not later than Three p.m., on Thursday, July 15, 1897.

By order,
SAML. BROWN,
Town Clerk.

Town Hall, Salford,
July 2, 1897.

EAST DEREHAM URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

SURPLUS TAR AND LIQUOR.

THE above Council are prepared to receive TENDERS for the surplus TAR and LIQUOR made at their Works for One Year.

Applications as to quantities to be made to the Manager.

Tenders to be sent in on or before July 24, 1897.

Liquor 5°, Twaddel's Hydrometer.

A. DRAGE,
Manager.

TAR.

THE Directors of the Cheltenham Gas- light and Coke Company invite TENDERS for the purchase of their surplus TAR for One, Two, or Three Years, commencing on the 1st day of October next.

Estimated Quantity, 2000 Tons per Year.

Tenders to state Price per Ton free on Rails at Cheltenham.

The Directors do not bind themselves to accept the highest or any tender.

R. O. PATERSON,
Manager.

Gas-Works, Cheltenham,
July 3, 1897.

TO COLLIERY PROPRIETORS, &c.

THE Directors of the Holyhead and North Wales Gas and Water Corporation, Limited, are prepared to receive TENDERS for their COAL SUPPLY.

Full Particulars may be had on application to the Company's Engineer, Mr. G. E. Saville, Conway Road, Penmaenmawr.

Sealed tenders, endorsed "Coal," to be sent in to me not later than Twelve noon on Monday, the 19th of July.

W. H. SINCLAIR,
Secretary.

Lawrence Buildings, Mount Street,
Manchester, July 9, 1897.

CAMBRIDGE UNIVERSITY AND TOWN GASLIGHT COMPANY.

TENDERS FOR COAL.

THE Directors of the above Company are prepared to receive TENDERS for the supply of best well screened GAS COAL, NUTS, and CANNEL, to be delivered between the 1st of August, 1897, and the 31st of July, 1898.

Forms of Tender and Specifications may be obtained on application to the undersigned.

Sealed tenders to be addressed to the Chairman not later than July 19, and endorsed "Tender for Coal."

The Directors do not bind themselves to accept the lowest or any tender.

By order,
R. BROWN,
Engineer and Manager.

Gas Office, Cambridge,
July 8, 1897.

GLASGOW CORPORATION.

(GAS DEPARTMENT.)

TENDERS FOR PURIFIERS, &c.

THE Corporation of Glasgow invite TENDERS for the construction of Four PURIFIERS and the IRON and STEEL WORK of Extension of ROOFS of Purifier-House and Lime-Store to be erected at their Dawsholm Gas-Works.

Copies of Specification and Form of Tender may be obtained, and Plans seen, at the Engineers' Office, 45, John Street, Glasgow.

Sealed offers, endorsed "Tender for Purifiers, &c.," and addressed to the subscriber, will be received by him not later than Tuesday, the 27th curt.

The Corporation do not bind themselves to accept the lowest or any offer.

J. D. MARWICK,
Town Clerk.

City Chambers, Glasgow,
July 7, 1897.

STAINES RESERVOIRS JOINT COMMITTEE

INCORPORATED BY ACT OF PARLIAMENT,
59 AND 60 VICT., CAP. 241.

ISSUE OF £250,000 £3 PER CENT. DEBENTURE STOCK.

Payment of Interest guaranteed by the three following Companies:—
The West Middlesex Water-Works Company,
The Grand Junction Water-Works Company, and
The New River Company,
jointly and severally.

NOTICE is Hereby Given, that the Joint Committee are prepared to receive TENDERS for the above ISSUE, being the first portion of the DEBENTURE STOCK created by the above Act, bearing Interest at 3 per cent. per annum, payable half yearly, and redeemable after the expiration of 25 Years from the date of issue, subject to Six Months' notice being given by the Committee.

Tenders must be delivered at the Office of the Committee, No. 19, Marylebone Road, N.W., not later than Two o'clock p.m., on Wednesday, the 21st July next.

Particulars and Conditions, together with Form of Tender, may be obtained at the said Office, or will be forwarded upon application; also of Messrs. Hollams, Sons, Coward, and Hawksley, Solicitors, 30, Mincing Lane, E.C.; and of Messrs. Prescott, Dimsdale, and Co., Limited, Bankers, 50, Cornhill, E.C.

By order of the Joint Committee,
F. H. WYBROO,
Secretary.

Office of the Committee:
19, Marylebone Road,
London, N.W., June 16, 1897.

GAS COAL.

THE Bethesda Urban District Council are prepared to receive TENDERS for the GAS COAL required at their Gas-Works during the ensuing Year, in such quantities and at such times as may be required (in all about 300 Tons), from the 1st of August, 1897, to the 31st of July, 1898.

The person whose tender is accepted will be required to enter into an agreement with the Council for the due performance of his contract.

The lowest or any tender not necessarily accepted.

Tenders to be sent to me on or before the 17th inst.

R. BENJAMIN EVANS,
Clerk.

Bron Arfon, Llanllechid,
near Bangor, July 9, 1897.

HINCKLEY URBAN DISTRICT COUNCIL.
(GAS DEPARTMENT.)

COAL, COKE, TAR, AND LIME CONTRACTS.

THE Gas Committee of the Hinckley Urban District Council invite TENDERS as follows:—

COAL.—For the supply of GAS COAL, about 5000 Tons, for the Year ending the 30th of June, 1898.

COKE.—For the purchase of all surplus COKE during the Year ending the 30th of June, 1898.

TAR.—For the purchase of all surplus TAR produced during the Year ending the 30th of June, 1898.

LIME.—For the supply of all the LIME required for Purification Purposes (about 200 Tons) during the Year ending the 30th of June, 1898.

Sealed and endorsed tenders to be sent to the undersigned on or before midday, Monday, the 19th inst.

Forms of Tender and further Particulars from

G. HELPS,
Engineer and Manager.

By Order of the Directors of
THE GASLIGHT AND COKE COMPANY.

ISSUE OF £25,000 "A" ORDINARY STOCK.

MR. ALFRED RICHARDS is favoured with Instructions from the Directors to SELL BY AUCTION, at the Mart, Tokenhouse Yard, London, E.C., on Monday, Aug. 9, 1897, at One for Two o'clock precisely, in Lots,

£25,000 OF "A" ORDINARY STOCK
OF
THE GASLIGHT AND COKE COMPANY,

ranking for a Standard Dividend of 10 per cent. subject to the Sliding-Scale; the last Dividend on the Company's "A" Stock having been at the rate of 12¼ PER CENT. PER ANNUM.

Particulars may be obtained at the OFFICES of the COMPANY, in Horseferry Road, WESTMINSTER; and of Mr. ALFRED RICHARDS, Auctioneer, 18, FINSBURY CIRCUS, E.C.

By Order of the Directors.
ALDERSHOT GAS AND WATER COMPANY.

NEW ISSUE OF 300 £10 FIVE PER CENT. PREFERENCE SHARES.

MR. ALFRED RICHARDS will Sell the above BY AUCTION, at the Mart, E.C., on Monday, July 26, at One o'clock precisely, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the
COLNBROOK GAS COMPANY, LIMITED.

MR. ALFRED RICHARDS will Sell by AUCTION, at the Mart, Tokenhouse Yard, E.C., on Monday, July 26, at One o'clock, as a going concern, the FREEHOLD GAS-WORKS of the Colnbrook Gas Company, Limited, advantageously situate at Colnbrook, about 16 miles from Town, and within easy distance of Colnbrook Station, G.W.R.

The Plant comprises five Retorts, Coal-Store, Condenser Washer-Scrubber, two Purifiers, and Gasholder, together with the Mains. Possession will be given on completion.

May be viewed and Particulars obtained of Messrs. GARNER AND SON, Solicitors, 159, High Street, UXBRIDGE; and of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

ISSUE OF STOCKS AND SHARES BY AUCTION UNDER PARLIAMENTARY POWERS.

MR. ALFRED RICHARDS undertakes the issuing by Auction of GAS AND WATER SHARES under Parliamentary Power.

He also holds MONTHLY SALES of GAS AND WATER SHARES at the Auction Mart, Tokenhouse Yard, E.C.

Terms for the issuing of Capital, and also for offering to auction Gas and Water Shares, and all Particulars relating thereto, may be had of Mr. Alfred Richards.

Offices: 18, FINSBURY CIRCUS, E.C.

By Order of the Directors.

TO TRUSTEES, INVESTORS, AND OTHERS.

NOTICE of Sale by Auction by Messrs. CRAWTER, at the Mart, Tokenhouse Yard, E.C., on Wednesday, Aug. 11, 1897, at Two o'clock precisely, of 625 SHARES of £10 each in the WALTHAM ABBEY AND CHESHUNT GAS AND COKE COMPANY, and known as "C" Shares, which, according to the present Price of the Company's Gas, entitles the Purchasers to a Dividend, when earned, of 10½ per cent.; thus offering a sound Investment of the most solid kind.

Particulars may be obtained at the OFFICES of the Company, Waltham Abbey, Essex; at the Mart; of Mr. J. CRAWTER, Land Agent, 41, BEDFORD ROW, W.C.; or of Messrs. CRAWTER, Land Agents and Auctioneers, Cheshunt, HERTS.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD
BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

HUNTER'S
OXIDE OF IRON.

JAMES HUNTER, MINER AND SHIPPER OF
NATURAL IRISH BOG ORE.

This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.

Samples and Prices on application.

5, PRINCES STREET, PORT GLASGOW.

Telegrams: "HUNTER, PORT GLASGOW."

Established 1872.

HEATHCOTE GAS COAL.

Rich in Illuminating Power and Yield of Gas. Above the Average in Weight and Quality of Coke.

Maintains a High Standard in Residuals.

THE GRASSMOOR CO., LD.,
CHESTERFIELD.

COKE-BREAKERS,

PRICES REDUCED.

(THOMAS & SOMERVILLE'S PATENT)

New Design, with two Cutting Rollers, making less Breese than their old pattern.

GEORGE WALLER & CO.,
165, QUEEN VICTORIA STREET, E.C.,
And at STROUD, GLOUCESTERSHIRE.

HOLMSIDE GAS COALS.

PRESENT DAILY PRODUCE OVER 4000 TONS.

LATEST ANALYSIS—By CHARLES PHILLIPS, Gas Examiner to Rotherham Corporation.

Yield of Gas Per Ton. . 11,205 Cubic Feet.
Illuminating Power, 16 7/10 Stand. Sperm. Candl.
Coke (of good & pure quality) 13¾ Cwt. Per Ton.
Sulphur . . . . A little over 1 Per Cent.
Ash . . . . . Under 1 Per Cent.
Tar . . . . . 163 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 103 Lbs. (Avoir.) Per Ton.

HOLMSIDE GAS COALS are supplied to the largest Gas Companies in England and on the European Continent; London alone consuming about half the produce.

SOUTH MOOR PELTON GAS COALS.

PRESENT DAILY PRODUCE AVAILABLE 2500 TONS.

RESULTS OF DIFFERENT ANALYSES:—

Yield of Gas Per Ton. . 10,500 Cubic Feet.
Illuminating Power . 17 Stand. Sperm Candl.
Coke (of excellent quality) . 13½ Cwt. Per Ton.
Sulphur . . . . . 1·13 Per Cent.
Ash. . . . . 1·34 Per Cent.
Tar. . . . . 180 Lbs. (Avoir.) Per Ton.
Ammoniacal Liquor 94½ Lbs. (Avoir.) Per Ton.

The HOLMSIDE and SOUTH MOOR COALFIELD possesses *a very great quantity of the best Coal;* and, whilst other Coal-Fields are becoming exhausted, this one is only being opened out, so that *the quality* of both the HOLMSIDE COALS, and the SOUTH MOOR COALS *may be relied upon for all practical purposes.*

These Coals may be bought through the Principal Merchants in England, or direct from

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-UPON-TYNE.

THORNLEY GAS COALS
WORKED BY THE
WEARDALE IRON & COAL CO., LD.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

Analysis made by
Messrs. J. & H. S. PATTINSON, *May 28, 1895,*

Yield of Gas per Ton . . 10,500 Cub. Ft.
Illuminating Power . . 16·9 Candles.
Coke (of good quality) . . 67·5 per Cent.
Sulphur . . . . . 0·58 „
Ash . . . . . 2·73 „

For Price, &c., apply to the
WEARDALE IRON & COAL CO., LD.
QUAYSIDE, NEWCASTLE-ON-TYNE.

THE SILICA FIRE-BRICK COMPANY,
OUGHTIBRIDGE, near SHEFFIELD,
MANUFACTURE
SILICA BLOCKS, BRICKS, AND CEMENT
OF SUPERIOR QUALITY
FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their
GREATER DURABILITY,
Strongly recommended where EXCESSIVE HEATS have to be maintained.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887,
for
CANNEL & COAL.

TYNE
BOGHEAD CANNEL.

Yield of Gas per ton . . . . . 13,155 cub. ft.
Illuminating Power . . . . . 38·22 candles.
Coke per ton . . . . . 1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 17·8 candles.
Coke . . . . . 70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 73·1 per cent.

For Prices and complete Analysis, apply to
THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE;
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.

Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
Shipments Promptly and Carefully Executed.

London Office: R. Cull, 84, Old Broad St., E.C.

Lanemark Coal Co.,
LIMITED.

LANEMARK CANNEL
AND GAS COALS.

Quotations and Analysis on Application to

LANEMARK COLLIERY,
NEW CUMNOCK, N.B.

Shipping Ports: All the principal Scotch Ports.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO
THE LOTHIAN COAL COMPANY,
LIMITED,
NEWBATTLE COLLIERIES,
DALKEITH, N.B.

LONDONDERRY GAS COALS
FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

For Prices and Particulars, apply to
S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

E. ASQUITH & CO.,
Hydraulic Engineers,
17, Mather Street, Ancoats, Manchester,
Fit up Plants for
Pressing Anthracene, Naphthalene, &c.
Competent Men sent out to erect same. Estimates given.

HEBBURN MAIN GAS COALS.
Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.
For Prices, f.o.b. Ship or Delivered by Rail, apply to
THE WALLSEND & HEBBURN COAL COMPANY, LTD.
8 Lombard Street,
NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

THOMAS TURTON
AND SONS, Limited,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS
ANVILS, VICES,
AND ENGINEERS' TOOLS GENERALLY.
London Office:
90, CANNON STREET, E.C.

W. J. JENKINS & CO., RETFORD.

COAL UNLOADING
AND
CONVEYING MACHINERY.

INCANDESCENT STREET LIGHTING.

THE ONLY SUCCESSFUL, ECONOMICAL, AND EFFICIENT
ANTI-VIBRATION SYSTEM.
Every Gas Engineer, Gas Manager, and Lighting Authority should adopt it.
Applicable to existing Lamps.
THE LARGEST INSTALLATION OF INCANDESCENT STREET LIGHTING IN ANY BRITISH TOWN IS ON THIS SYSTEM.
SUCCESSFUL RESULTS GUARANTEED IN ALL SITUATIONS.

Full Particulars on Application to
THE ANTI-VIBRATION INCANDESCENT LIGHTING COMPANY, Limited,
12 & 14, WESTGATE ARCADE, BRADFORD, YORKS.
WE HOLD THE ORIGINAL PATENTS.

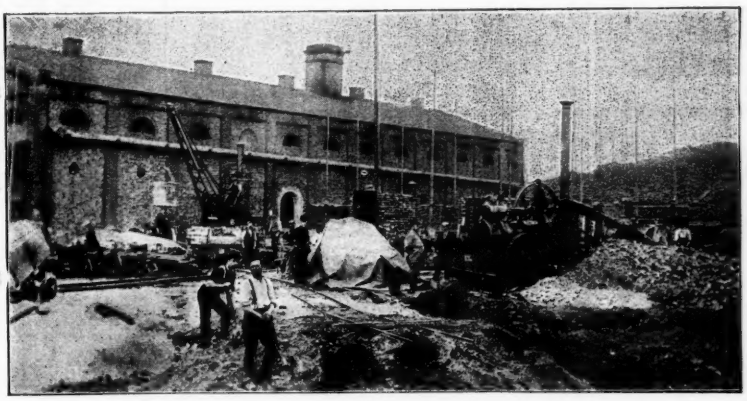
J. & H. ROBUS,

ENGINEERS AND CONTRACTORS FOR GAS AND WATER WORKS,

20, BUCKLERSBURY, LONDON, E.C.

Telegraphic Address:
"Robustness,
London."

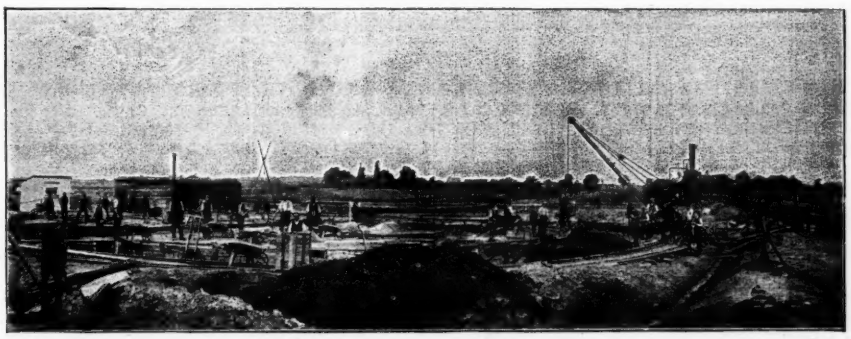
Exchange Telephone:
No. 756 Bank.



Contractors for every description of GAS-WORKS PLANT, including Main Laying.

ESTIMATES SUBMITTED FOR COMPLETE OR PARTIAL ERECTION
BY OUR OWN SKILLED WORKMEN.

Gasholder Tanks, all Sizes.



Reservoirs and Water Work of every kind, including Main Laying.

GASEOUS FIRING
DEEP, MEDIUM, OR SHALLOW FURNACES.

RETORT WORK OF EVERY DESCRIPTION.

COMPLETE INSTALLATIONS OR OTHERWISE.

Reconstruction and Renewals with Economy in first cost, and undoubted Large Annual Savings.

PLANS, ESTIMATES, AND EVERY PARTICULAR FURNISHED.

JAMES OAKES & Co.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1¼ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

THE STAFFORDSHIRE TUBE CO.

TELEGRAMS:

"EVESON, BIRMINGHAM."

BOLDON GAS COALS.

ANALYSIS.

Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

For Prices, &c., apply to

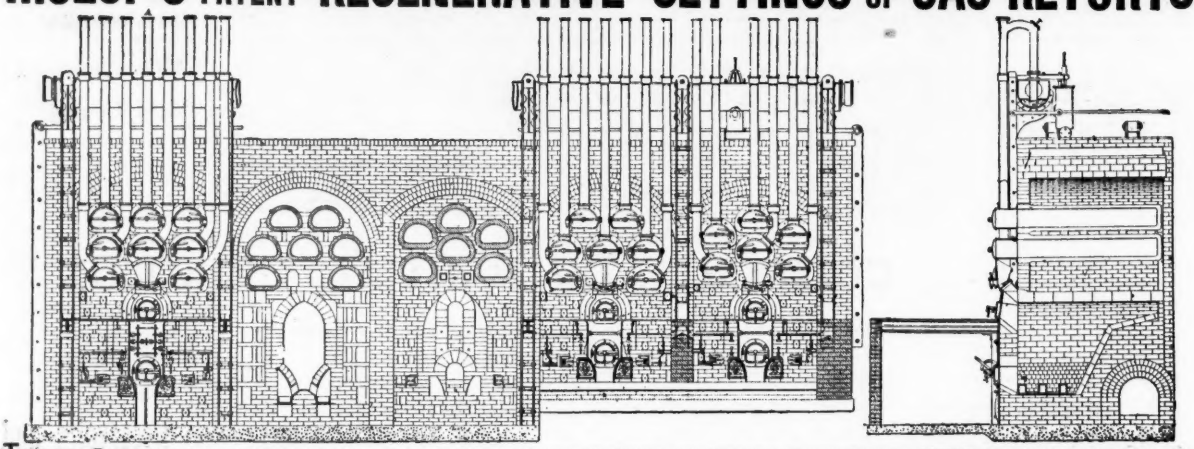
W. H. PARKINSON,

THE HARTON COAL CO., LTD.,

NEWCASTLE-ON-TYNE.

Telegraphic Address: "PARKINSON NEWCASTLE.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE POSITIVELY UNRIVALLED IN PRODUCTIVE CAPACITY, DURABILITY, AND SIMPLICITY OF MANAGEMENT. RETORTS OF ORDINARY DIMENSIONS CARBONIZING FROM 17 TO 20 CWT. OF ENGLISH AND 20 TO 24 CWT. OF SCOTCH COAL PER 24 HOURS, DEPENDING UPON THE NATURE OF THE COAL, AND PRODUCING UP TO FULLY 13,000 CUBIC FEET PER MOUTHPIECE IN THE SAME TIME, AND WITH THE SMALLEST EXPENDITURE OF FUEL ATTAINABLE, AND RETURNING IN PROFIT THE ENTIRE COST OF ERECTION WITHIN TWELVE TO EIGHTEEN MONTHS; AND THUS REDUCING TO INSIGNIFICANCE THE INCREASED COST OF THESE SETTINGS OVER THE COMMON OR GENERATOR FURNACE SYSTEMS.

THESE SETTINGS ARE EXTENSIVELY ADOPTED, AND ARE ERECTED UPON THE SHALLOW AND STAGE FLOOR PLANS. THEY ARE ADAPTED TO ANY EXISTING ARRANGEMENTS, AND PERFECT SATISFACTION GUARANTEED. THE COMPOSITION OF FIRE-RESISTING AND OTHER SPECIAL FIRE-CLAY MATERIALS FURNISHED IS OF THE HIGHEST ORDER; AND THE SYSTEM AS A WHOLE, AS NOW PERFECTED, IS THE RESULT OF LONG EXPERIENCE AND CAREFUL STUDY OF THE PRINCIPLES OF GASEOUS FIRING.

Drawings and Tenders are furnished for the complete erection of Benches, including Retort and Bench Mounting of the most modern and approved description; or existing Ovens fitted up with the Patentee's arrangements.

Agents: **Messrs. JONAS DRAKE AND SON**, Retort Setters and General Carbonizing Engineers, Ovenden, Halifax, Yorkshire, Sole Agents for England, Wales, and Foreign Countries; **C. M. HAMILTON**, Retort Setter and Contractor, Hamilton, Agent for Scotland and Ireland; Principal Agent, **R. F. HISLOP** (Son of Patentee), General Constructing and Carbonizing Engineer, Gas-Works, Paisley, N.B., and to whom all Inquiries should be addressed in the first instance.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non*

TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED AND AFFORDING THE HIGHEST SATISFACTION.

The Patentee's SELF-SEALING CAPS FOR THE TOP OF ASCENSION-PIPES, and his "SPECIAL" FLUE PORT BOXES, are most important additions to his Carbonizing Plant.

SPENT LIMES NO LONGER WASTE PRODUCTS.

Under G. R. HISLOP'S Patents, all Spent Limes are effectively recovered at from one-third to one-half the cost of New Lime.
Further Information and Pamphlets from Principal Agent.

MOBBERLEY & PERRY STOURBRIDGE.

Manufacture & supply best quality of

Gas Retorts (SEGMENTAL, HORIZONTAL, or INCLINED.)

Special Bricks & Blocks for GENERATOR & REGENERATOR FURNACES.

FIRE BRICKS, LUMPS, & TILES, BLUE STAFFORDSHIRE VITRIFIED BRICKS FOR PAVING, &c., &c.

EVERY REQUISITE FOR GAS-WORKS. Retort Setters sent to any part of the Kingdom.

Contractors for the erection of Retort-Benches complete.

London Agents:

BALE & HARDY,

Gas Engineers and Contractors,

BRIDGE HOUSE, 181, QUEEN VICTORIA STREET, E.C.

COLUMNLESS GASHOLDERS

ON

PEASE'S STEEL CABLE SYSTEM.

Great Saving in Cost, and Absolutely Reliable in Working.

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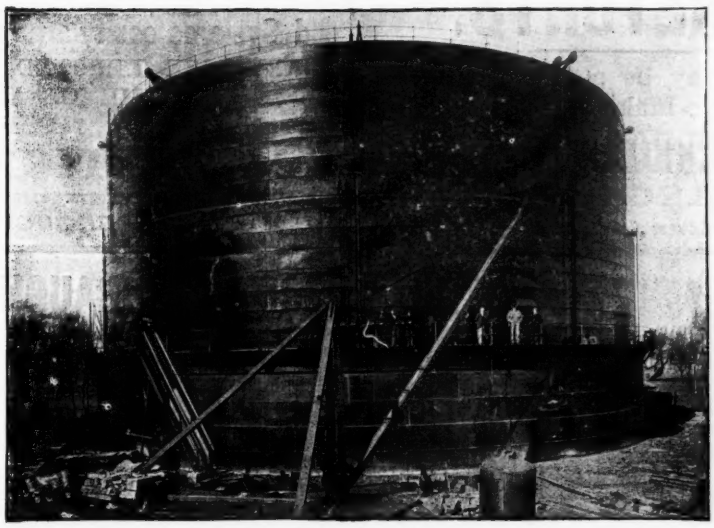
TYNE DOCK
NEWBURN-ON-TYNE
ST. AUSTELL
BIRKENHEAD
NOTTINGHAM (4)
MANCHESTER (4)
DARLINGTON
BARROW-IN-FURNESS
HASLINGDEN
SELBY
STONE
DERBY
BIRMINGHAM
PRESTON MILLS
FALKIRK (N.B.)
BARCELONA (Spain)
PERTH (W. Australia)
PERTH (N.B.)
And many other places.



TWO-LIFT GASHOLDER. Capacity, 360,000 cub. ft. Steel Tank, 126 ft. 6 in. dia.; 25 ft. deep.

— PERTH GAS-WORKS. —
(From a Photograph)

Orders now in hand for Patent Holders for—
WAR OFFICE, Woolwich
FALMOUTH
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TRURO
VALPARAISO
BUCHAREST, Roumania
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BARKING
YSTAD, Sweden

These Holders are certified by users to be STEADIER UNDER WIND PRESSURE than Holders with Columns.

INSPECTION INVITED.

Freights Reduced in Shipping Orders.

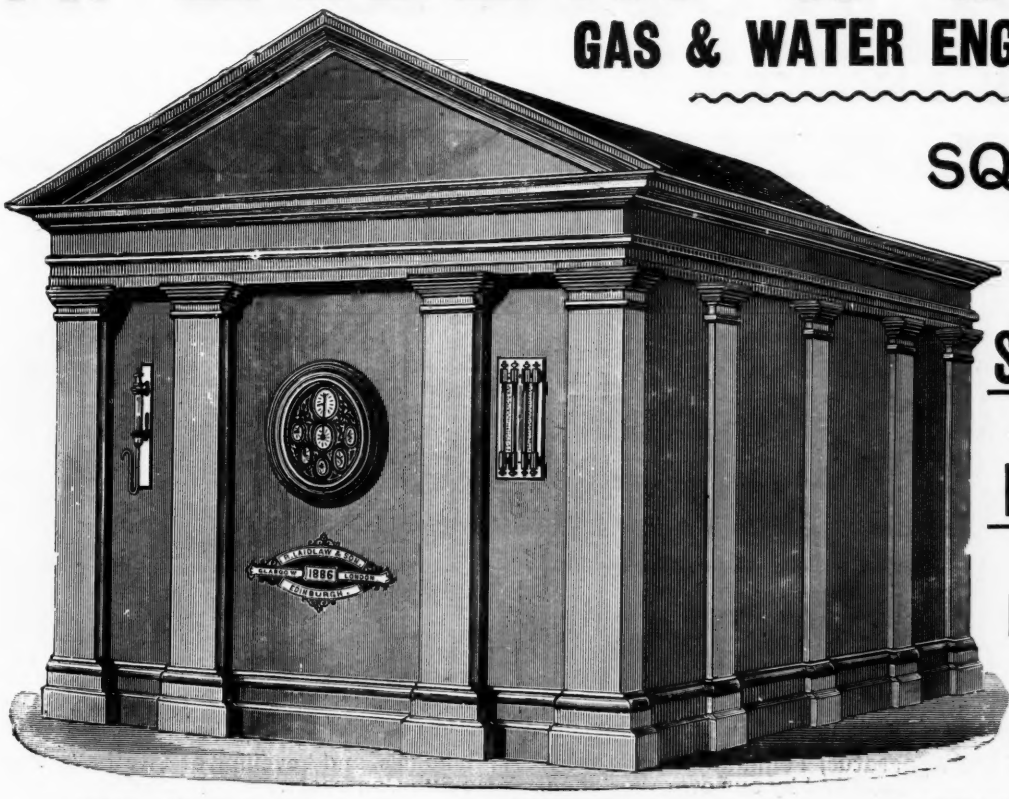
Manufacturers and Patentees,

Telegrams: "GASHOLDER."

ASHMORE, BENSON, PEASE, & CO., LIMITED,
STOCKTON-ON-TEES.

R. LAIDLAW & SON

GAS & WATER ENGINEERS.



SQUARE

(OR ROUND)

STATION

METERS

ALL SIZES.

SIMON SQUARE WORKS, EDINBURGH. | ALLIANCE FOUNDRY, GLASGOW. | 6, LITTLE BUSH LANE, LONDON.

ARROL-FOULIS

Patent Automatic Machinery

FOR

DRAWING AND CHARGING GAS-RETORTS.

Full Particulars may be obtained from the Sole Makers,

SIR WILLIAM ARROL & CO., Limited,

GLASGOW.

[See Illustrated Advertisement, July 6, p. 70.]

PETTIGREW'S PATENT

Sulphate of Ammonia Plant

ON THE CONTINUOUS SYSTEM

Is the newest in the Market, and is the outcome of practical experience in Sulphate Making.

Old Systems easily and cheaply converted.

ANY SIZE ERECTED COMPLETE AT HOME OR ABROAD.

Write for Particulars, Testimonials, and References to

GEO. PETTIGREW & Co.,

GAS AND CHEMICAL ENGINEERS,

MIDDLESBROUGH-ON-TEES.

THE "COOMBE" DRAUGHT SCREEN.
Protection granted, 1896, No. 2075.

THE "COOMBE" DRAUGHT SCREEN FOR INCANDESCENT BURNERS.

ADVANTAGES.

1.—Prevents draughts of cold air from ascending the Chimney, and thereby lengthens the life of Chimney and Mantle.
2.—Prevents attempts to light spills, &c., in Bars and Restaurants, by which many Mantles are destroyed.
3.—Presents an ornamental appearance, wh'ch greatly adds to the beauty of the Burner.
4.—Prevents "Lighting-Back," and keeps out dust and dirt.

SOLD EVERYWHERE.

Wholesale of the Patentees,

ALFRED ARCULUS & CO., GLASS MANUFACTURERS, BIRMINGHAM.

"An Incandescent Burner without a Draught Screen is like a Man without a Collar."

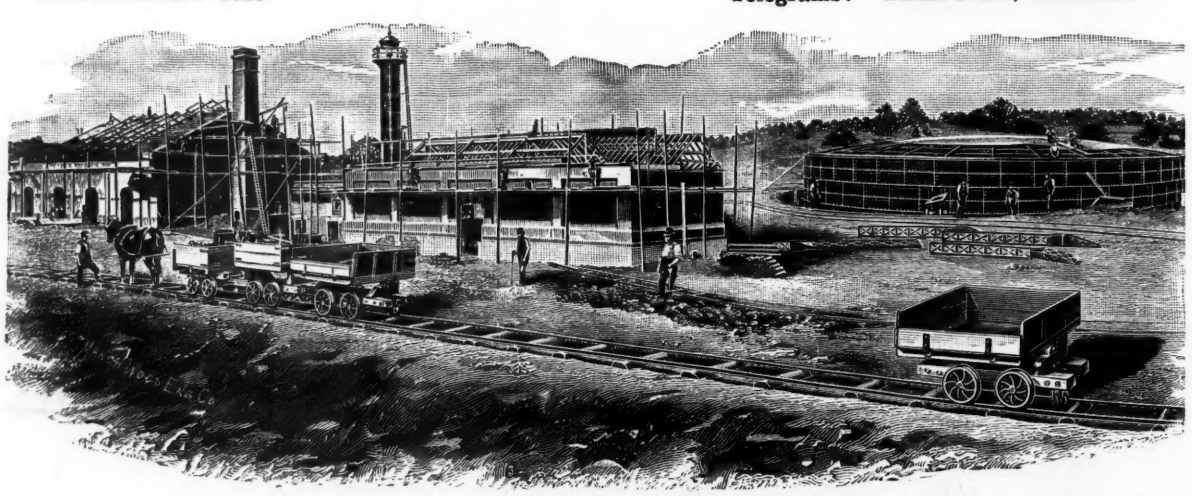
R. DEMPSTER & SONS,

LIMITED,

GAS ENGINEERS and CONTRACTORS,

ELLAND, YORKS.

ESTABLISHED 1855. **Telegrams: "DEMPSTER, ELLAND."**



Engraved from Photograph of Complete Gas-Works in course of Construction.

The WHOLE of the Apparatus, Foundations, Retort Work, Buildings, and Levelling of Site have been executed by our own Workmen. No Sub-Contracts.

Estimates and Illustrations for complete Works, or for any detailed parts, supplied gratis on application.
Tenders given for all kinds of Structural Ironwork.

HARRIS & PEARSON,

STOURBRIDGE, ENGLAND

MANUFACTURERS OF

FIRE-CLAY GAS-RETORTS, FIRE-BRICKS, LUMPS, & TILES of Every Description.

GLAZED BRICKS AND PORCELAIN BATHS.

JOHN BROWN & CO., LTD., SHEFFIELD.

Proprietors of

ALDWARKE MAIN, CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

ALDWARKE MAIN GAS COAL

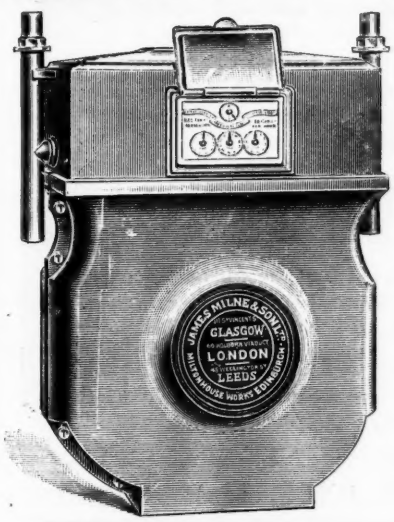
Analysis: 12,600 Feet of 19-Candle Gas per Ton.

Value in Pounds of Sperm, 820·80.

VERY FREE FROM IMPURITIES.

TELEGRAMS: "ATLAS, SHEFFIELD."

MILNE'S PATENT COMPOSITE DRY GAS-METER



THE WORKING PARTS OF A TIN-CASE DRY METER ENCLOSED IN A TWO-PART IRON-CASE.

THIS Meter combines all the advantages of the Dry Gas-Meter with the strength and durability of the Wet Meter. It consists of Cast-Iron Cases front and back enclosing the bellows, and screwed to each other with the Division-Plate between; while the upper portion containing the Valve Chambers and Index is made of extra thick Tinned Iron—the Side Tubes being made of brass, with suitable provision for Trapping any Condensation.

It is well known that the only parts of an ordinary Tin-Case Dry Meter which are attacked by outside Corrosion are the bottom and the lower parts of the Sides, and also the Side Tubes. In this Composite Meter, these parts are made either of Cast Iron or Brass, and thus rapid deterioration is prevented, and the weight is not unduly increased.

JAMES MILNE & SON, LTD.,

GAS ENGINEERS, Milton House Works, EDINBURGH,

LONDON. GLASGOW. LEEDS.

LONDON OFFICE

60, QUEEN VICTORIA ST. E.C.

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"ECLAIRAGE LONDON."

TELEPHONE No 43.
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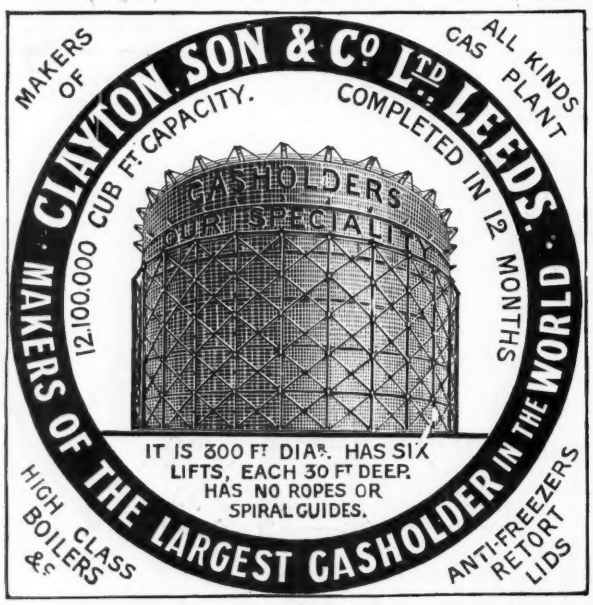
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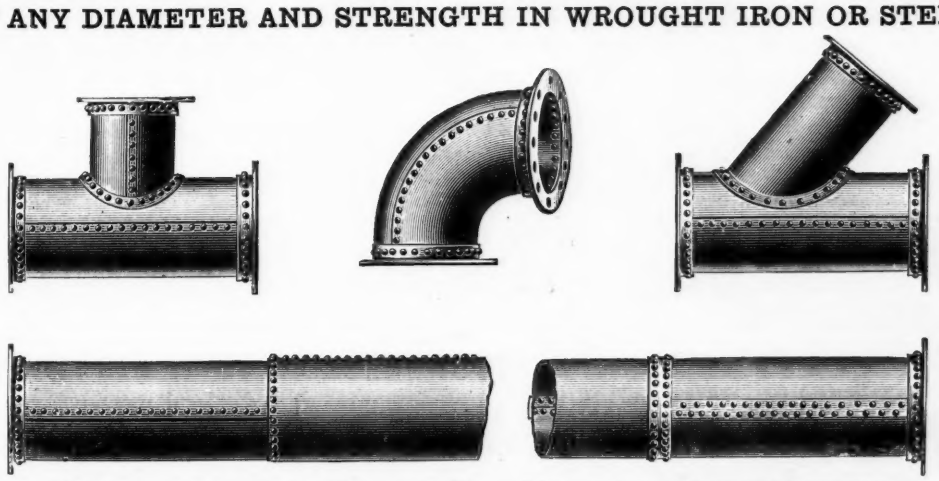

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[See also Advt. p. 88.

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